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THE USE OF STRESSBREAKERS IN TISSUE BORNE PARTIAL DENTURES

George Franklin McGee, D.D.S., San Francisco

REMOVABLE partial dentures can be divided into two classes, those that are entirely tooth supported and those that are supported partly by the teeth and partly by the oral tissues. Every denture should be planned with the greatest possible skill and good judgment, but the tooth supported type does not present nearly as many problems as does the combination supported type. This discussion will be confined to the latter class, and further, to only those designed as replacements on the lower jaw. The loss of all or some of the lower posterior teeth, leaving no distal abutments and with all anterior teeth remaining, occurs more frequently than any other type of tooth loss.

Before a method of replacement can be decided on, certain facts must be considered. Information is gained first from the examination of the patient's oral conditions with the help of roentgenograms. Second, the patient's tolerance and attitude are determined. Third, the economic aspect is considered. Fourth, with the help of study models a suitable plan or design can be obtained to meet the several requirements of the individual patient. This procedure should result in the restoration of the patient's missing teeth with special emphasis on function and comfort, without dangerously impairing the health of the remaining teeth and supporting tissues.

Examination

A reasonable time spent on the examination will prevent many costly failures. Any appliance will place an added strain on the remaining teeth, and for this reason all doubtful teeth should be removed. Devitalized teeth and those with periodontal involvement are poor risks as abutments. The tissue in the edentulous areas should be healthy and firm. If it is excessive over the crest of the

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Assistant clinical professor of denture prosthesis, College of Dentistry, University of California.

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ridge and easily displaceable, it is often best to reduce its bulk surgically so as to produce a more favorable foundation. Sharp knife-edged ridges of soft tissue offer poor support and call for the use of positive relief. A sharp mylohyoid ridge is usually covered with very thin soft tissue and is one of the greatest sources of discomfort in this area. Again, positive relief will sometimes be sufficient, but in the more extreme cases surgical reduction is indicated. The construction of a denture without making these corrections when necessary will result in remakes, dissatisfied patients and many time-consuming adjustments.

Tolerance of the Patient

It is unfortunate that all patients in need of partial denture service do not have the proper attitude toward it. The difference in the ability of patients to tolerate the presence of an artificial denture is tremendous. The ideal patient has confidence in the operator and, with adequate instruction on what to expect and how the new appliance functions, readily adapts himself to the new conditions. The exacting patient is skeptical of everything, and more time is necessary for explanation from the examination to the finished product. The choice of retainers is limited by esthetic considerations, and retention must sometimes be increased beyond the point of adequacy because of fears or complexes. Early recognition of the patient's attitude and tolerance is desirable, although many times difficult, in order to select the correct design and quote an adequate fee.

Economic Aspect

Economics is a subject not usually mentioned in a discussion of this type. It would certainly be ideal if costs were not one of the factors that determine the type of restoration to be made. Cost of the materials used does not influence the value of the product so much as the actual hours of work by the operator, when the simple type of construction is compared with the more intricate. Since some of the persons who need tissue borne partial dentures have limited incomes, it is important to be ready with a design to fit the circumstance. It may not be the best, but it should be adequate to meet the conditions.

Design

Whenever a stationary object is directly attached to a movable object, the connection should be flexible. The tissue borne partial denture is supported by the abutment teeth (the stationary object) and the saddles (the movable object). The forces created by the act of mastication are both vertical and torsional and are resisted by the rigidity of the lingual bar and borne by the abutments and the tissue under the saddles.

The design then must include a lingual bar rigid enough to prevent any flexing, either vertical or lateral, for by this means the torsional force is reduced to a great extent on the abutments and saddles. This point must have special attention when the residual ridges are flat. The short lingual flanges of the saddles do not provide an adequate stabilizing effect, and this lack must be made up by greater rigidity of the lingual bar. The vertical or occluding force displaces the soft tissue in the edentulous area, and the flexible retainers allow the saddle to move. The movement allowed by most stressbreakers can be measured in fractions of a millimeter near the abutment tooth, but as the saddle extends distally, this movement becomes greater in direct proportion to its length. The length of the saddle and the condition or type of supporting tissue are the factors that determine the stressbreaker to be used in order to provide the desired amount of movement. It would be ideal if the movement of the saddle and the movement

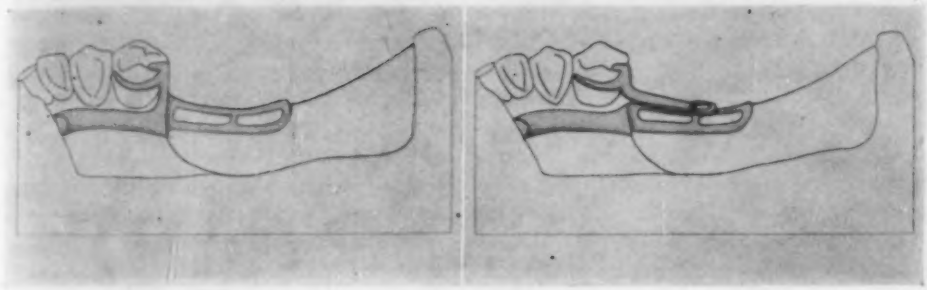

Fig. 1.—Left: Rigid design often used for tissue borne partial dentures, though it is seldom satisfactory. Right: Distal extension attached to conventional clasp, showing metal-to-metal contact with other portion of appliance, which prevents upward movement of saddle

of the supporting tissues reached their limits at the same time, as both would then bear the load equally.

Tissue Support.—The saddles covering the edentulous areas must support a portion of the stress of mastication, which is in direct proportion to the number of teeth replaced. The saddle coverage must be such as to distribute these forces over as great an area as possible. The saddle outline extends buccally to the external oblique ridge, distally it covers the retromolar pad (this is usually an excellent bearing area, though it often is unused) and lingually it extends slightly below the mylohyoid ridge. This lingual flange adds to the stabilization of the entire appliance and any lack of coverage limits this effect.

In the finished denture, the tissue-contacting surface of the saddle should conform to the shape of the tissue as it is displaced by the stress applied. This results in more comfort for the patient and is accomplished by the use of a secondary impression. When the try-in of the denture is complete, the surface of the tissue is covered with an impression material (any of the soft waxes made especially for the purpose, or paraffin). The denture is placed in the mouth, and the patient closes in centric relation. On removal, the heavy bearing areas where the base plate has come through the impression material are scraped, new material is added and the denture is replaced in the mouth. This is repeated until the stress is evenly distributed over the surface. This technic eliminates many time-consuming adjustments and adds greatly to the comfort of the patient.

Retainers.—When a distal end extension attachment or stressbreaker is mentioned, most thoughts center on a type that interposes a precision made movable connector between the retainer and the saddle portion of the partial denture. An example is the Chayes distal extension attachment which has been improved by McCollum, West and others. Most such attachments have a degree of movement that can be controlled and provide excellent results when not contraindicated by anatomy or relations of the teeth or cost of production.

The simplest and most commonly used stressbreakers are made of wrought wire or certain cast clasps of Roach Design. Here the movement is attained from the flexibility of the metal of the retainers and they must be provided with stops or rests so formed as to permit a certain amount of slippage. An

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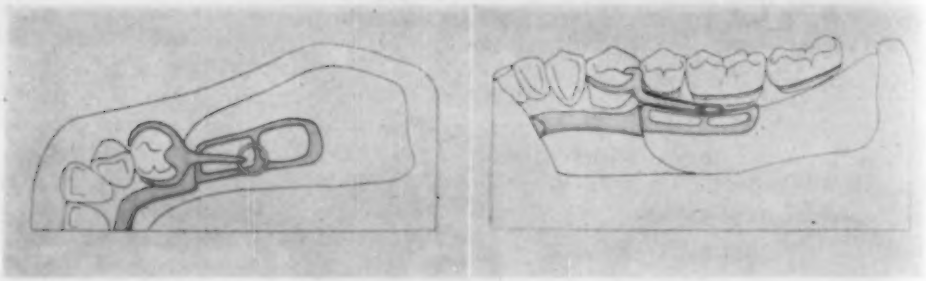

Fig. 2.—Left: Attachment in simplest form. All edges are rounded and polished, with a hole for retaining loop at extreme end. Right: Heavy black line indicates location of small space in plastic material necessary to allow stressbreaking action

inserted stop such as the McKay mortice rest should not be used, as it would prevent the desired movement.

Cast conventional clasps attached by long wrought wire connectors to a point well back on the saddle certainly remove the strain from the abutments, but in most cases they overload the saddle portion.

Breaking the stress by means of a split lingual bar is possible, but each section in the split portion must still be rigid enough to dissipate the torsional forces. A vertical sliding attachment between the saddle area and the clasp would probably improve this type of construction.

The ball and socket and sliding devices, such as the Dresch attachment, were early attempts to gain the desired movement. These and many other devices have been used in attempting to divide the applied forces between the abutment teeth and the edentulous areas. Based on clinical experience, a stressbreaker should:

1. Be part of or attached to a good retainer that does not require constant adjustment.

2. Allow desired vertical movement of the saddle toward the soft tissue of the ridge. This movement should be adjustable if possible.

3. Prevent movement in the opposite direction (displacement away from ridge). The use of indirect retention as part of the design usually enables the stressbreaker to meet this requirement.

Broken Action Conventional Clasps.—All too often these combination supported lower partial dentures are constructed with conventional clasps rigidly attached to the rest of the framework. (Fig. 1, left). In selected cases the conventional clasp not only is one of the best retainers but also acts as a stabilizer. It can be provided with adequate stressbreaking action in the following manner.

The denture is waxed in the usual way, except that the connector is separated at its lowest point from the rest of the pattern. (Fig. 1, right). A distal extension is added slightly lingually of the crest of the ridge for a distance of 12 to 15 mm. (Fig. 2, left). This extension is rectangular with rounded edges, the vertical dimension being greater than the lateral dimension and tapering distally. After casting and polishing, a small hole is made in the distal end, through which is passed a loop of clasp wire (Fig. 2, left). The parts are assembled on the model and completed in the usual manner.

After the occlusion is corrected and

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the denture has been worn for at least 24 hours, the clasps are heated by repeated applications of a hot wax spatula to the exposed concave surface under the stop. The heat travels along the distal extending arm and warms the plastic surrounding it. Force is applied with the spatula to the clasp in an upward direction only until about 0.5 mm. of movement is obtained (shaded area in Fig. 2, right). With care, this step is easily accomplished, but if too much force is applied there is danger of losing the correct relation between the clasp and the rest of the appliance.

If the clasp is allowed to move in a downward direction, it will allow the saddle to move upward. This is prevented by obtaining a metal-to-metal contact with the casting directly below the connector as shown in Figure 1, right.

The standard types of stressbreakers produce a hinge-like action near the abutment tooth, allowing most of the downward movement of the saddle to occur at the distal end. By placing the rotation point at the end of the distal extension, a more even movement is produced over the entire bearing area, resulting in greater comfort for the patient. With the longer saddles, the greater movement is still in the distal portion where good support is usually found, namely the retromolar pad area.

This simple type just described may be refined in two ways. First, a metal housing may be constructed to cover the top and sides of the extension arm, held in correct position by the metal ring that provides the retention (Fig. 3, left). When the heat is applied to the clasp, this portion moves upward into the plastic and remains in this position, providing a metal stop to the upward movement of the distal extending arm.

Second, the metal ring providing the retention may be replaced by a straight threaded metal rod that extends to the lingual surface. (Fig. 3, right). After completion of the denture the clasp can be removed by removing this threaded rod, and the upper surface of the distal extension arm can be ground away to permit the amount of movement desired when reassembled. Short crowned abutment teeth, which limit vertical height, have always been one of the contraindications for use of a distal extension attachment. By using plastic teeth as replacements, this attachment can be used for many patients with short crowns.

One of these versions should provide a comfortable, easily constructed remov-

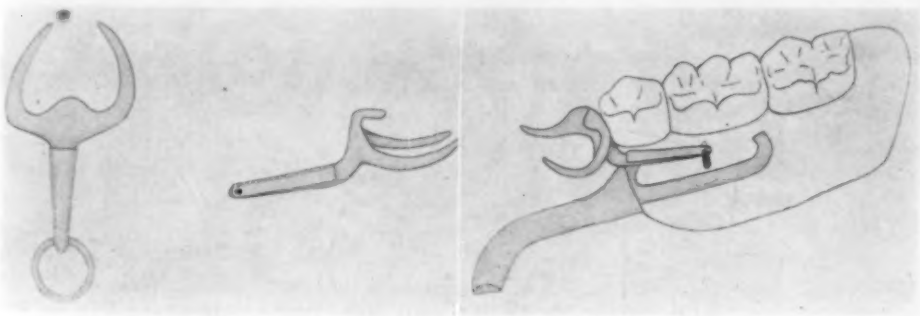

Fig. 3.—Left: Use of metal housing could provide metallic stop for distal extension under heavy occlusal load. Right: Use of threaded clasp wire in place of loop allows clasp to be removed. Desired movement is obtained by grinding upper edge of distal extension

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able partial denture at a cost that the average patient is able to afford.

Conclusions

All combination supported partial dentures should be provided with some form of stressbreaker.

Conventional clasps may be provided with this essential broken stress action.

Most stressbreaker attachments produce a hinge-like action near the abutment. When this center of movement is placed further distally, a more even parallel movement of the entire saddle is obtained.

Lingual bars should be rigid enough to resist torsional movemests of the saddle portion and lessen this strain on the abutment teeth.

In split bar construction, each section of the bar must be rigid enough to resist this twisting action.

Saddle coverage in the edentulous areas should be as large as possible.

A secondary impression in the saddle area adds greatly to the comfort of the patient.—*450 Sutter Street.*

ROENTGENOGRAPHIC TECHNIC FOR ANTERIOR INTERPROXIMAL REGION

Duane W. Lovett, D.D.S., Iowa City

FOR MAKING ROENTGENOGRAMS of the maxillary and mandibular anterior interproximal regions, the bite-wing film has been most generally used. The primary fault of the bite-wing technic is the distortion of the images of the maxillary or mandibular teeth or both, produced by the pronounced opposite inclinations of these teeth to the plane of the film in its proper position. It is roentgenographically impossible to project with one exposure a true image of both the upper and lower anterior teeth of the same region on a single plane or flat film.

The roentgenographic technic presented here for the anterior interproximal region has as its purpose the correction of the defects and distortion inherent in the bite-wing technic, while preserving all its beneficial attributes. My technic, which makes use of an inexpensive appliance, is simple and affords economy in the selection of film and the many combinations of exposures obtainable.

The principle of this technic is to make projections of the anterior interproximal regions separately in the maxilla and the mandible. To accomplish this objective, a lead-insulated plastic film holder is utilized so that only one half of the film is exposed to the x-rays at a time (Fig. 1). The plastic body of this appliance incorporates a commercially pure lead insulation plate 1 mm. thick, 23 mm. wide and 18 mm. high. There are plastic film retaining flanges at the sides and bottom. The body of the appliance is curved laterally to an arc of a circle 5 inches in diameter. The tooth rest of the appliance is of plastic with one section, the incisal rest, projecting 7 mm. at the level of the

Associate professor of radiology and oral diagnosis, State University of Iowa, Iowa City, Iowa.

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top of the lead insulation plate. A second section, the lingual rest, projects 5 mm. upward from the incisal rest with the front surface of the lingual rest 4 mm. from the inner surface of the top of the body of the appliance. This appliance is designated as an interproximal film shield, but for brevity and simplicity it will be designated in this manuscript as the film shield.

A child size film packet, which is approximately 36 mm. long and 23 mm. wide, is used with the appliance.

Technic

The film packet is inserted in the film shield with the tube side of the packet toward the lead shield (Fig. 1, A). This insulates the inserted half of the film from the action of the x-radiation when the unprotected half is exposed. The right lateral interproximal projections are made as follows:

For the maxillary projection, place the protruding half of the film on the lingual side of the maxillary lateral incisor in such a manner that the lingual surface of the tooth rests against the lingual rest of the film shield and the incisal edge of the tooth rests on the incisal rest of the film shield. The patient presses his left thumb against the superior border of the film to hold it firmly against the vault tissue (Fig. 2).

With the occlusal plane of the maxilla parallel to the floor, the vertical angulation of the central ray will be, in the average case, perpendicular to the labial surface of the lateral incisor. If the inclination of the maxillary incisors is unusual, the central ray is directed perpendicular to the plane that bisects the angle formed by the film and the crown of the tooth. The horizontal angulation should be such that the central ray is directed perpendicular to a tangent to the line of arch at the midpoint of the lateral incisor (Fig. 3).

After completion of the exposure, the film shield and film are removed together from the mouth. The film is then removed from the film shield and the exposed half is inserted in the film shield with the tube side of the film toward the lead insulating plate.

For the mandibular exposure, the film, in the film shield, is placed on the lingual side of the lateral incisor in such a manner that the lingual surface of the tooth rests against the lingual rest of the film

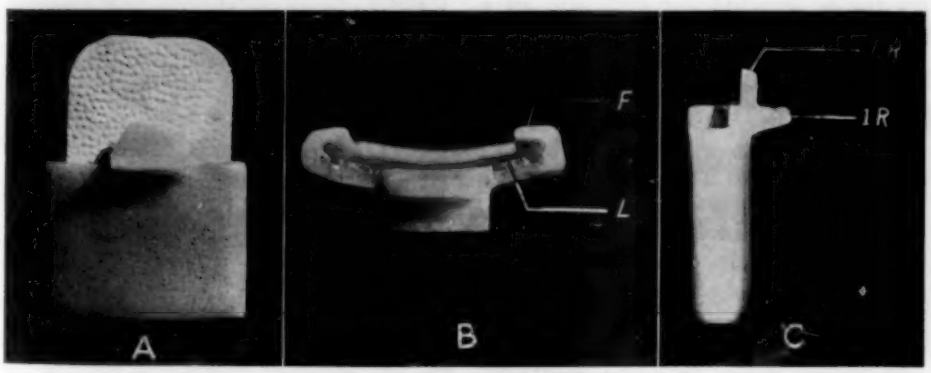

Fig. 1.—A: *The interproximal film shield with the film packet in place.* B: *Top view of the film shield showing the plastic film-retaining flanges* (F) *and the lead insulating shield* (L). C: *Side view of the film shield showing the incisal tooth rest* (IR) *and the lingual tooth rest* (LR)

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Fig. 2.—The interproximal film shield and the film, retained by the thumb of the patient's left hand, in position for the exposure of the upper right lateral region

shield and the incisal edge of the tooth rests on the incisal rest of the film shield. This position is maintained by firm pressure of the index finger of the patient's left hand on the film, with the thumb under the chin.

With an average inclination of the mandibular teeth, the vertical angulation of the central ray should be perpendicular to the labial surface of the lateral incisor. For an unusual inclination of the mandibular incisors, the central ray is directed perpendicular to the plane that bisects the angle formed by the film and the crown of the tooth. The horizontal angulation should be such that the central ray is directed perpendicular to a tangent to the arch at the midpoint of that lateral incisor. Exposure time for the mandible will be slightly less than for the maxilla.

In the maxilla, with a normal alignment of teeth, this film should accurately record the mesial surface of the cuspid, the mesial and distal surfaces of the lateral incisor and the distal surface of the central incisor, as well as the interproximal alveolar crests between the cuspid and lateral incisor and the lateral incisor and central incisor. In the mandible the mesial surface of the cuspid, the mesial and distal surfaces of the lateral incisor, the distal surface of the central incisor and the alveolar crests between the cuspid and lateral incisor and the lateral incisor and central incisor should be accurately recorded.

The central projections of the interproximal regions are made in the same manner as the right lateral projections. For both the maxillary and mandibular central projections, the film and film shield are positioned in such a way that the mesial sections of the lingual surfaces of the right and left central incisors rest against the lingual rest of the film shield, and the mesial sections of the incisal edges of both central incisors rest on the incisal rest of the film shield (Fig. 4).

For vertical angulation the central ray will be directed perpendicular to the labial surfaces of the central incisors and through the mesial embrasure. For the horizontal angulation, the central ray will be perpendicular to a tangent to the line of arch at the point of the mesial embrasure. For the maxillary exposure the film may be held in position by the patient with the thumb of either the right or left hand, and for the mandibular exposure the film may be retained

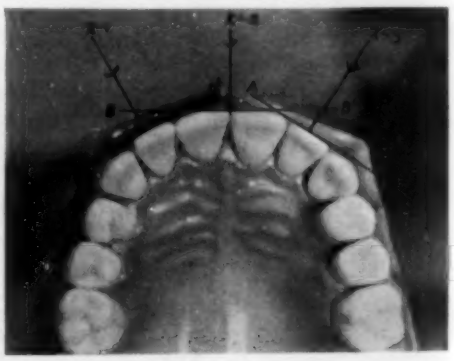

Fig. 3.—The horizontal angulation of the central ray. X-1 *represents the central ray for the right lateral exposure. It is perpendicular to a tangent* (C-C^1) *to the arch at the midpoint of the right lateral incisor.* X-2 *represents the horizontal angulation for the central projection, and* X-3 *the horizontal angulation for the left lateral projection*

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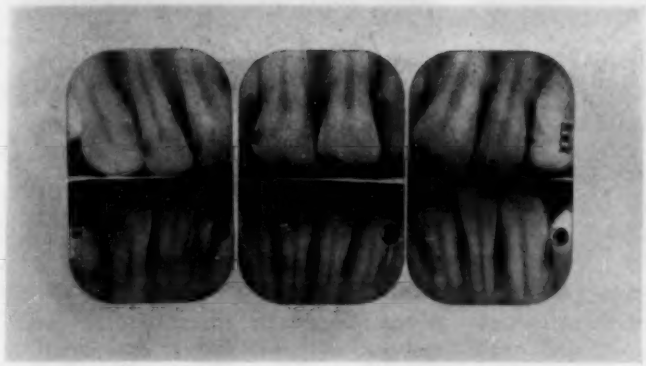

Fig. 4.—Anterior interproximal roentgenographic surveys made with the use of the interproximal film shield

by the patient with the index finger of either hand. Again, exposure time for the mandibular view will be slightly less than for the maxillary view.

These exposures of both the maxillary and mandibular central interproximal regions will record accurately the mesial surface of the right lateral incisor, the mesial and distal surfaces of the right central incisor, the mesial and distal surfaces of the left central incisor, the mesial surface of the left lateral incisor and the interproximal alveolar crest between the right lateral incisor and the right central incisor, the interproximal alveolar crest between the two central incisors and the interproximal crest between the left central incisor and the left lateral incisor.

The technic for the left lateral projections of the maxillary and mandibular interproximal regions corresponds to that used for the right lateral interproximal regions.

Any combination of the three maxillary and the three mandibular projections can be made. As an example, the right and left lateral maxillary projections can be made on one film. If the teeth overlap, it may be convenient to make a mesial and a distal projection of the same region on the same film.

Conclusions

The anterior interproximal roentgenographic technic in which a film shield is used, is a simple, workable, effective means of obtaining true projections of the anterior interproximal regions. The individual exposures of each of the maxillary and mandibular regions, with individual angulations for each region, truly corrects the distortion obtained in the bite-wing technic, yet affords all of the advantages of the bite-wing projections. An additional advantage is that a combination of any two of the three maxillary and the three mandibular projections can be made on one film.

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ROENTGENOGRAPHIC TECHNICS MADE TO ORDER

Albert G. Richards, B.S. (Ch.E.), M.S., Ann Arbor, Mich.

A ROENTGENOGRAPHIC technic is a procedure involving a number of factors which, when properly combined, yield a desired diagnostic roentgenogram. For a long period very little change occurred in either the factors utilized or the manner in which these factors were combined in dental roentgenographic technics. Today it is possible to devise roentgenographic technics that are made to order.

Since roentgenograms are essentially shadow pictures, the production and properties of shadows should be reviewed. A source of radiation, an object or structure the image of which is desired, and a screen or film for the reception of the shadow image are the three basic requirements for the production of shadows of any type. The x-ray tube is the source of radiation used in dental roentgenography, while the teeth and contiguous structures are the objects of which shadow images are desired. The images can be rendered temporarily visible by means of a fluorescent screen or can be permanently recorded on an x-ray film.

As the x-ray beam leaves the cone of the x-ray machine, the rays diverge. The intensity of the x-ray beam decreases inversely as the square of the distance from the x-ray tube. This relation is commonly called the inverse-square law.

Shadows consist of two parts: the umbra, which is the interior portion of the image, and the penumbra, which is the blurred region at the periphery of the image (Fig. 1, left). The distinctness or clarity of outline with which the image of a given object will register on a film or screen is called the *definition* of the image. An image possessing a minimum amount of penumbra is considered to have good or "high" definition. Definition is improved by the use of a small stationary source of radiation.

The source or focal spot in the usual dental x-ray unit measures about 0.05 or 0.06 inches square, but if the machine is allowed to vibrate during the exposure, the effective dimensions of the source are increased by the extent of the vibration. Definition can be improved either by decreasing the distance between the object and the film or by increasing the distance between the source and the film. Nature imposes an anatomic limit on the approximation of the film to the teeth, and the inverse-square law determines the maximum practical distance that the source can be removed from the film.

The ideal x-ray beam would be composed of parallel rays which would permit the formation of shadow images having exactly the same dimensions as the object (Fig. 1, right, A). Actually, however, the rays of the x-ray beam are not parallel but divergent. This divergence results in magnified images (Fig. 1, right, B). The amount of enlargement can be minimized by either decreasing the object-film distance or increasing the source-film distance. How close the film can be placed to the teeth is determined by the anatomy of the mouth, and the inverse-square law determines how much it is practical to increase the source-film distance.

Assistant professor in dentistry, School of Dentistry, University of Michigan.

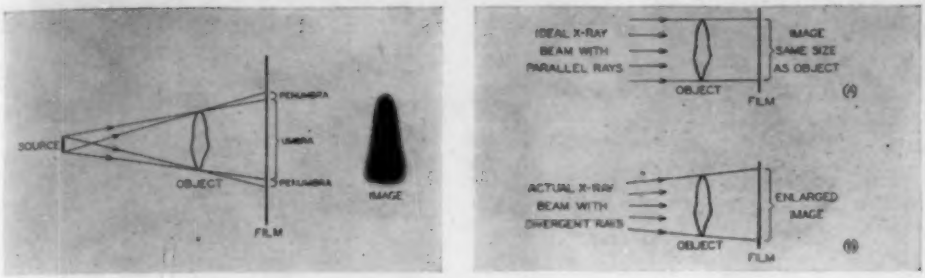

Fig. 1.—Left: Shadow production. Right: Effect of divergence of x-ray beam on size of image

Certain improvements in dental roentgenographic technics were developed years ago, but only recently have these improvements achieved any degree of popularity. These changes were mainly in the current and voltage values, the method of positioning the film packet relative to the teeth, and the source-film distance employed.[1-7]

When the conventional technic is used, the film packet is placed in the mouth with some part of the packet touching either the incisal edges or the lingual cusps of the teeth and the rest of the film inclined to form an angle with the long axes of the teeth. Then, in order to produce an image having the same length as the tooth itself, the central ray of the x-ray beam is directed at the apex of the tooth and perpendicular to a plane which bisects the angle formed by the plane of the film packet and the long axis of the tooth (Fig. 2, A).[2,8] Even though this method reproduces approximately the true length from the lingual apex to the lingual cusps and from the buccal apexes to the buccal cusps, there still is present a type of distortion which makes it difficult to judge the relative lengths of the

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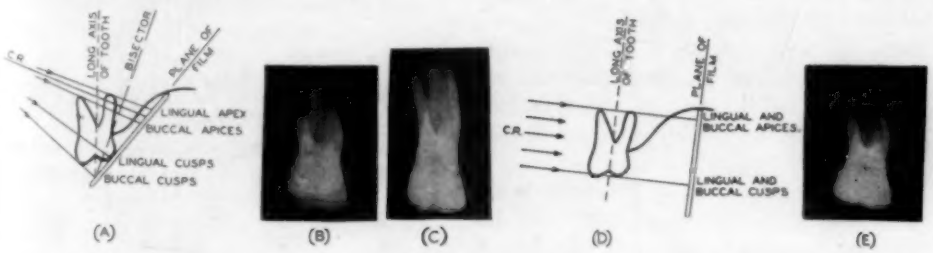

Fig. 2.—A and B, bisecting principle. C, elongated profile image of tooth. D and E, production of profile image of tooth

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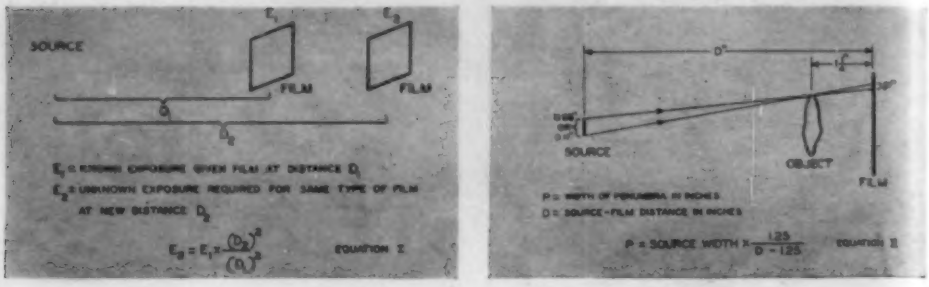

Fig. 3.—Left: Relation between exposure and source-film distance. Right: Relation between penumbra width and source-film distance

roots, because the lingual root extends higher in the roentgenogram than the buccal roots (Fig. 2, B). Similarly, the lingual cusps appear above the buccal cusps. With the conventional film packet position it is possible to produce a silhouette or profile image of the tooth by directing the central ray perpendicular to the long axis of the tooth. However, another type of distortion, called elongation, will usually accompany the desired profile image (Fig. 2, C).

Profile images of the teeth, free of elongation, can be produced by placing the film packet parallel to the long axes of the teeth and directing the central ray perpendicular to the plane of the film and the long axes of the teeth (Fig. 2, D and E). In order to have the packet parallel to the long axes of the teeth, it usually must be positioned some distance from the teeth at a place where the oral cavity is more spacious. This positioning of the packet involves an increase in the object-film distance, which in turn results in poor definition and increased enlargement. Both the definition and enlargement difficulties can be minimized by properly increasing the source-film distance.

Since the intensity of the x-ray beam decreases in a certain manner with increased source-film distance, the length of exposure must correspondingly be increased to compensate for the reduced intensity of the rays (Fig. 3, left). By using the conventional 8 inch source-film distance as a standard and assigning it a time-distance factor of unity, time-distance factors for other source-film distances can be calculated, using equation I. Some results are listed in Table 1.

For example, an operator would customarily expose the mandibular molar region for 6 seconds when operating with an 8 inch source-film distance. If he wished to use a source-film distance of 16 inches, he would have to use an exposure four times as long, because 4 is the new time-distance factor. The new exposure for the same teeth would now be 6×4 or 24 seconds.

The merit of various source-film distances can be quantitatively compared (Table 1) by using the theoretic width of penumbra (Fig. 3, right) as a measure of the definition of an image. Equation II is derived for the case where the object is 1¼ inches from the film. For the 8,

Table 1

Source-film distance, inches	Time-distance factor	Width of penumbra, inches	Percentage enlargement
8	1	0.011	18.5
16	4	0.005	8.5
20	6.25	0.004	6.7
36	20.25	0.004	3.6

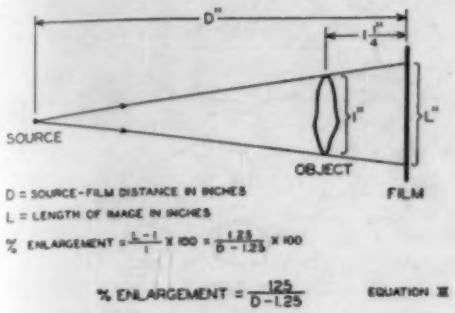

Fig. 4.—Relation between per cent enlargement and source-film distance

16 and 20 inch source-film distances a dental x-ray unit with its 0.06 inch square source is used in the calculations, whereas a medical x-ray unit with a 0.11 inch square source is used in the calculations for the 36 inch source-film distance technic. The 16 inch technic reduces the width of the penumbra to less than half the value obtained with the conventional 8 inch technic. Adding another 4 inches to the source-film distance reduces the width of the penumbra one-thousandth of an inch, but simultaneously requires more than a 50 per cent increase in exposure time. The 36 inch technic with its larger source offers no better definition than the 20 inch technic and does require very lengthy exposures.

Equation III affords a means for comparing the enlargement that a 1 inch tooth, located 1¼ inches from the film, experiences with various source-film distances (Fig. 4). Considerable enlargement accompanies the conventional 8 inch technic. This amount is reduced more than 50 per cent with the 16 inch technic and decreased still further with the longer distances (Table 1).

All particles of a patient's head become sources of secondary radiation when irradiated by the primary x-ray beam of the unit.[9] These secondary rays differ from the primary rays in that they are less intense and travel in all directions. Secondary rays produce an undesirable fog or gray veil over the entire area of the film, which tends to reduce the contrast of the image.

To decrease the amount of fog from secondary radiation on a film, the film packet manufacturers have incorporated a thin sheet of lead in the back of each packet. This sheet of lead absorbs the secondary rays which normally would reach the film through the back of the packet. To limit the amount of secondary radiation which reaches the film through the front of the packet requires that the number of sources of secondary rays be limited. This limitation is accomplished by using a lead diaphragm with a small aperture, mounted in the cone of the unit, to limit the diameter of the primary x-ray beam. Irradiating a smaller area of the patient's face reduces the number of sources of secondary radiation, which in turn reduces the fogging of the film.

Figure 5, left, was produced without a lead diaphragm in the pointed cone. The beam, when measured 7 inches from its source, covered a circular area 4⅛ inches in diameter on the patient's face. All factors used in the production of Figure 5, right, were the same as for Figure 5, left, with the exception of a diaphragm. This diaphragm limited the di-

9. Muncheryan, H. M., *Modern Physics of Roentgenology*, ed. 2. Los Angeles: Wetzel Publishing Company, 1940.

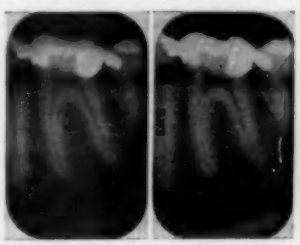

Fig. 5.—Effect of diaphragm on fog caused by secondary radiation. Left: No diaphragm used. Right: Diaphragm used

ameter of the x-ray beam to 2½ inches when measured 7 inches from the x-ray source. The reduction in the diameter of the x-ray beam produced a decrease of 63 per cent in the area irradiated and an appreciable decrease in secondary radiation. Only in Figure 5, left, do the large restorations have a gray veil over them, caused by the fogging of secondary radiation. This fogging is most noticeable in the thin or clear areas on the roentgenogram, but it is present in the darker areas as well. It is this fogging which causes Figure 5, left, to appear darker and to have less contrast than Figure 5, right.

The voltage applied to an x-ray tube determines the penetrating ability of the x-rays produced.[10] Increased voltages generate more penetrating rays, which subsequently produce less contrast in the roentgenogram. Conversely, decreased voltages generate less penetrating rays, which produce greater contrast in the roentgenogram. Accompanying the increased or decreased penetration is the need for shorter or longer exposures, respectively.

The conventional dental x-ray unit is operated at 110 volts as indicated by the voltmeter. With certain dental x-ray machines,[11] when 110 volts are supplied to the step-up transformer in the head of the x-ray unit, a potential of 63,000 volts or 63 K.V.P.[12] is applied across the x-ray tube. If a time-voltage factor of unity is assigned to the 63 K.V.P. setting of the unit, then a factor of 3/2 must be used in the calculation of the new exposure when the unit is operated at 55 K.V.P. Some representative figures are contained in Table 2. The factors were determined experimentally.

Table 2

Time-voltage factor*	Voltage applied to x-ray tube, K.V.P.†	Corresponding voltmeter reading for Ritter Model B x-ray unit
3/4	70	120
1	63	110
3/2	55	100
5/2	50	90

*Caution! Time-voltage factors do not apply to the use of intensifying screens in cassettes. For such equipment the factor is higher.

†K.V.P. is the abbreviation for kilovolt peak. Most dental x-ray units can be changed in this manner. One should consult his x-ray serviceman.

Table 3

Current, Ma.	Time-current factor
7.5	4/3
10	1
12.5	4/5
15.0	2/3

For example, an operator would customarily expose the mandibular molar region for 6 seconds when operating at a voltage setting equivalent to 63 K.V.P. If he wishes to use the voltage setting equivalent to 55 K.V.P., he would have to increase the exposure by a factor of 3/2, which is the new time-voltage factor. The new exposure for the same teeth would now be $6 \times 3/2$ or 9 seconds.

The amount of current which flows through the x-ray tube is measured by the milliammeter. The standard dental x-ray machine is adjusted to operate with 10 milliamperes of current.

The density or blackening of a roentgenogram is largely controlled by the amount of exposure the film receives. The exposure is measured in milliampere-seconds (abbreviated Ma.S.), which is the product of the number of milliamperes (Ma.) of current flowing through the tube multiplied by the number of seconds (S.) that the x-rays are turned on. Theoretically it does not matter whether an exposure of 6 Ma. for 10

10. Hodge, H. C., and others, Factors Influencing the Quantitative Measurement of the Roentgen-Ray Absorption of Tooth Slabs. IV. Absorption Coefficient Factors. *Am. J. Roentgenol.* 34:817 (Dec.) 1935.

11. Ritter Model B.

12. Peak kilovolts are abbreviated K.V.P.

seconds or 10 Ma. for 6 seconds be given a region which requires a 60 Ma.S. exposure. However, it would be more practical to use the 10 Ma. for 6 seconds exposure, since there is more danger of movement by the patient if the longer time is involved.

If a time-current factor of unity is assigned to the 10 Ma. setting of the unit, then a factor of 10/15 or 2/3 must be used in the calculation of new exposures when the unit is operated at 15 Ma. Some factors are listed in Table 3.

For example, an operator would customarily expose the mandibular molar region for 6 seconds when operating at 10 Ma. If he wished to use 7.5 Ma., he would have to increase the exposure 4/3 times, which is the new time-current factor. The new exposure for the same teeth would now be $6 \times 4/3$ or 8 seconds.

No current greater than 10 Ma. should be used with a dental x-ray tube operating at 63 K.V.P. The use of higher currents would in this case decrease the life expectancy of the tube. Currents as high as 15 Ma. can safely be used with 50 K.V.P. without harming the tube.

Dental films are available in various speeds. The higher the speed of a film the less exposure is required to produce a roentgenogram of desired density. Approximate time-film speed factors can be assigned to the various types of films to facilitate conversion of exposures from one film type to another. These factors and corresponding film types are listed in Table 4.

Table 4

Time-film speed factors	Film types
1	Kodak Regular
4/5	Rinn Universal-BB
1/2	DuPont S
1/2	Kodak Radia-Tized
1/2	Kodak Rapid-Processing
1/2	Rinn Intermediate-DC
1/4	DuPont D
1/8	Kodak Ultra-Speed
1/12	Rinn Extra-Fast

Table 5

Time-developing factor	Developing time at 65 F., minutes
1	3½
3/4	5

For example, an operator would customarily expose the mandibular molar region for 6 seconds when using Kodak Regular dental film packets. If he wishes to use Kodak Radia-Tized film, he would have to reduce the length of the exposure to one-half, which is the new time-film speed factor. The new exposure for the same teeth would now be $6 \times 1/2$ or 3 seconds.

A disadvantage in using the higher speed types of films is that they do not have the wide latitude of exposure possessed by the slow speed films. In other words, when using the faster films the operator must be more critical in his appraisal of the size and type of the anatomic structures in order to avoid overexposure or underexposure of the film.

Fast developing solutions are available commercially which will completely develop a dental film in 3½ minutes at 65 F. If the developing time at this temperature is prolonged to 5 minutes, a 25 per cent reduction in exposure time can be realized (Table 5).

For example, an operator customarily would expose the mandibular molar region for 6 seconds for 3½ minute development at 65 F. If he wished to prolong the development time to 5 minutes at 65 F., he would have to multiply the length of exposure by a factor of 3/4, which is the new time-developing factor. The new exposure time for the same teeth would now be $6 \times 3/4$ or 4½ seconds.

Using the data contained in the tables, it is possible to devise a roentgenographic

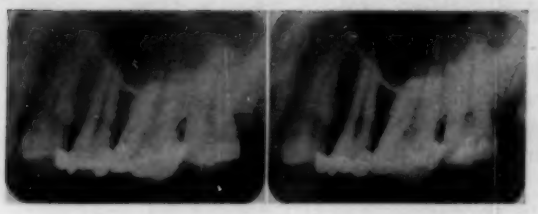

Fig. 6.—Technic designed for increased contrast. Left: 63 K.V.P., 10 Ma., Kodak Regular film and 6 second exposure. Right: 50 K.V.P., 12.5 Ma., Kodak Radia-Tized film and 6 second exposure

technic to meet every need. Changing from one technic to another requires that the exposure-time values of the original technic be modified, for use in the new technic, in accordance with the new conditions. Assigned to each part of a roentgenographic technic (source-film distance, voltage, current, film speed, developing time) is an exposure-time factor (Tables 1-5).

The appropriate exposure-time factor involved in a change of only one part of a given technic is determined by dividing the exposure-time factor of the new part by that of the original part. An example of a change of only one part of a given technic would be a change from using DuPont S film, which has a factor of 1/2, to DuPont D film, with a factor of 1/4 (Table 4). The new factor, 1/4, divided by the original factor, 1/2, indicates 1/2 to be the exposure-time factor involved in this change of film types.

If more than one part of a roentgenographic technic is changed, the over-all exposure-time factor is the product of the factors for each change. As an example, if in addition to the mentioned change of film type the value of the current were changed from 10 Ma. (factor=1) to 12.5 Ma. (factor=4/5) (Table 3), the over-all factor would be:

$$\frac{1/4}{1/2} \times \frac{4/5}{1} = \frac{2}{5}$$

If the original technic with DuPont S film and 10 Ma. required a 5 second exposure for a certain region, then the new technic with DuPont D film and 12.5 Ma. would require the original exposure-time (5 seconds) multiplied by the over-all factor (2/5), or a 2 second exposure.

Example 1.—Design a technic for increased contrast (Fig. 6).

In place of a technic employing 63 K.V.P., 10 Ma. and Kodak Regular film, the operator would change to a technic employing 50 K.V.P., 12.5 Ma. and Kodak Radia-Tized film.

Time-voltage factor (Table 2):
50 K.V.P. 5/2
63 K.V.P. 1

Time-current factor (Table 3):
12.5 Ma. 4/5
10.0 Ma. 1

Time-film speed factor (Table 4):
Kodak Radia-Tized film 1/2
Kodak Regular film 1

$$\frac{5/2}{1} \times \frac{4/5}{1} \times \frac{1/2}{1} = 1, \text{ the over-all factor.}$$

The new exposure time for a given region would be determined by multiplying the former exposure time by the over-all time factor. If the former exposure time for the maxillary bicuspids and first molar region had been 6 seconds when operating with 63 K.V.P., 10 Ma. and Kodak Regular film, then the new exposure time for this same region would be 6 × 1 or 6 seconds if 50 K.V.P., 12.5 Ma. and Kodak Radia-Tized film were used. In this example no change of exposure time would be necessary.

Example 2.—Design a technic for high definition.

In place of a technic employing an 8 inch source-film distance and Rinn Intermediate-DC film, the operator would change to a tech-

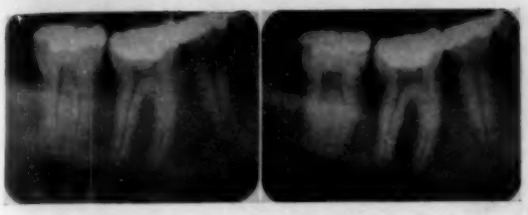

Fig. 7.—Technic designed for increased contrast and definition. Left: 63 K.V.P., 8 inch source-film distance Kodak Regular film, 10 Ma. and 6 second exposure. Right: 50 K.V.P., 16 inch source-film distance, Kodak Ultra-Speed film, 12.5 Ma. and 6 second exposure

nic employing a 20 inch source-film distance and Rinn Extra-Fast film.

Time-distance factor (Table 1):
20 inches.....(approx.) 6
8 inches 1

Time-film speed factor (Table 4):
Rinn Extra-Fast film.....1/12
Rinn Intermediate-DC film..... 1/2

$$\frac{6}{1} \times \frac{1/12}{1/2} = 1, \text{ the over-all factor.}$$

Since the over-all time factor in this example is unity, the new technic would utilize the same exposure time values as the old.

Example 3.—Design a technic for increased contrast and definition (Fig. 7).

In place of a technic employing 63 K.V.P., 8 inch source-film distance, Kodak Regular film and 10 Ma., the operator would change to a technic employing 50 K.V.P., 16 inch source-film distance, Kodak Ultra-Speed film and 12.5 Ma.

Time-voltage factor (Table 2):
50 K.V.P..... 5/2
63 K.V.P..... 1

Time-distance factor (Table 1):
16 inches 4
8 inches 1

Time-film speed factor (Table 4):
Kodak Ultra-Speed film..... 1/8
Kodak Regular film..... 1

Time-current factor (Table 3):
12.5 Ma..... 4/5
10.0 Ma..... 1

$$\frac{5/2}{1} \times \frac{4}{1} \times \frac{1/8}{1} \times \frac{4/5}{1} = 1,$$
the over-all time factor.

Since the over-all time factor in this example is unity, the new technic would utilize the same exposure time values as the old.

Example 4.—Design a technic for greater penetration and short exposure time.

In place of a technic employing 63 K.V.P., 10 Ma., Kodak Regular film and 3½ minutes' developing time at 65 F., the operator would change to a technic employing 70 K.V.P., 7.5 Ma., Kodak Radia-Tized film and 5 minutes' developing time at 65 F.

Time-voltage factor (Table 2):
70 K.V.P..... 3/4
63 K.V.P..... 1

Time-current factor (Table 3):
7.5 Ma. 4/3
10.0 Ma. 1

Time-film speed factor (Table 4):
Kodak Radia-Tized film..... 1/2
Kodak Regular film..... 1

Time-developing factor (Table 5):
5 minutes at 65 F..... 3/4
3½ minutes at 65 F..... 1

$$\frac{3/4}{1} \times \frac{4/3}{1} \times \frac{1/2}{1} \times \frac{3/4}{1} = 3/8,$$
the over-all time factor.

The new exposure time for a region which formerly required 4 seconds of exposure, would be 4 × 3/8 or 1½ seconds.

Summary

The production and properties of shadow images are discussed with special emphasis on how definition is improved and enlargement is minimized.

The role that source-film distance,

diaphragms, voltage, current, film speed and developing time play in the production of dental roentgenograms is indicated. Each of these items is carefully evaluated and assigned a conversion factor which facilitates a change from one technic to another.

Examples are given to show how a roentgenographic technic may be devised to fulfill specific requirements.

FUNCTIONAL ANALYSIS OF OCCLUSION

John R. Thompson,* M.S., D.D.S., M.S.D., Chicago, and
F. Winston Craddock,† Cert.Dent.(N.Z), M.S.D., Dunedin, New Zealand

THE term "functional analysis" is used to describe a method of diagnosis of occlusal disharmony or frank malocclusion which places proper emphasis on the biologic and functional aims of orthodontic, prosthetic, or restorative treatment rather than on merely anatomic or cosmetic aims. Functional analysis aims to produce an occlusion which will not only possess the traditionally accepted characteristics of "normality" in the formal or anatomic sense, but which will be efficient in the functional or physiologic sense as well.

To fulfil this condition an occlusion must be developed which is in functional harmony with the facial skeleton supporting it, with the muscles of expression and mastication and with the temporomandibular joints. The concept is thus a dynamic or kinematic one rather than a static one and looks beyond the mutual occlusal relations of the teeth to the masticating mechanism as a whole. It has important practical consequences for the description of the normal, for diagnosis and for treatment and method.

Description of the Normal

The inadequacies of the older norms established on a static consideration of occlusion became evident in any attempt to classify individuals of the same race and same general physical build; but they were even more apparent when an attempt was made to apply them to different races. It is now realized that occlusal harmony and biologic efficiency can exist over a wide range of anatomic variation; and conversely, an occlusion which has a superficial appearance of normality may be in fact abnormal or even pathologic when subjected to functional analysis.

Diagnosis

It is also realized that merely by occluding upper and lower casts in the hand and looking at individual tooth relations a correct diagnosis is almost impossible except in the simplest cases. Even these may be deceptive because an apparently normal occlusion, judged in the static manner, may not function normally. The inclusion of functional analysis as a supplement to traditional methods of diagnosis will go far toward substitution of rationalism for empiricism in treatment and toward the elimination of

*Professor of orthodontics, Northwestern University Dental School, Chicago.

†Senior lecturer in prosthetic dentistry, University of Otago Dental School, Dunedin, New Zealand.

those otherwise inexplicable relapses and failures in orthodontic, periodontal, prosthetic and restorative treatment.

Treatment and Method

1. The method of functional analysis will include, as a first step, determination of the path of closure of the mandible from rest position to habitual occlusion, which may or may not be a true centric occlusion. Determination of the path of closure can be made clinically by close observation of slow and unstrained closing movements. From the point of initial contact of the teeth, particular care should be taken to detect the presence of an anterior, lateral or posterior movement of the mandible during the final part of the closure. Such displacement is not present in the normal, as all teeth occlude simultaneously. A similar determination may be made by comparing cephalometric roentgenograms taken first with the mandible in rest position and then in habitual or acquired occlusion of the teeth. Superimposed tracings of the mandible in these two positions will reveal any serious departure from a normal closing movement. Roentgenograms of the temporomandibular joint itself, again in rest and occlusion positions, will reveal displacement of the condyle in abnormal cases. In practice, more than one method should be used to confirm the diagnosis.

2. The amount of free-way space or intermaxillary space in rest position should be determined next. Such a determination is fundamental to diagnosis. This can be estimated both clinically and roentgenographically. Deviations of more than and less than the usual two or three millimeters will be found. An excessive free-way space is characteristic of such widely differing conditions as Class II malocclusions associated with undereruption of posterior teeth, and mutilated cleft palate cases.

3. As an aid to diagnosis of temporomandibular joint disturbances, the condyles may be palpated while jaw movements are performed. In this way limitation of movement, abnormal mobility, or clicking and crepitation of the joint may be detected. When opening is accompanied by mandibular deflection to one side, this, too, can be confirmed by palpation in some instances. The method of palpation should be supplemented by close observation of the temporomandibular joint region and of the general pattern of muscular action when the patient performs various jaw movements.

4. Certain types of impairment of function or abnormality of muscular balance, notably limited movement of the temporomandibular joint and lack of function of the external pterygoid muscles (ankylosis or paralysis), are accompanied by increased function of the suprahyoid and infrahyoid muscles. In normal opening the hyoid bone remains practically stationary; but when mandibular depression is almost entirely dependent on contraction of the hyoid group, increased muscular tension can be observed under the chin. Cephalometric roentgenograms will reveal that in wide opening the hyoid bone moves downward to a position of greater mechanical advantage than it normally occupies.

5. Adequate diagnosis necessitates an articulator analysis of occlusion. This will provide information which cannot be gained by an examination of the mouth or of casts alone. It can be made only after accurate impressions have been secured and casts mounted in an anatomic articulator by means of a face-bow transfer of the upper cast. An articulator of fixed average type is adequate for the purpose of analysis. A slight difference between the patient's condylar path inclination and that reproduced by such an articulator has been found to produce experimentally only an insignificant difference in occlusal relations in the move-

ment from rest position to occlusion or indeed in any movement from an eccentric occlusion to a centric one within the functional range. On the other hand, orientation of casts in approximate relation to the initial opening axis is important; and it is for this reason that a conventional type of anatomic articulator with a face-bow transfer is recommended. The casts must not be mounted in what appears to be centric occlusion, but in rest or centric relation with the aid of wax or plaster records of rest position. These are most conveniently made in separate left and right sections, and if any doubt exists as to their reliability they should be made in duplicate. Closure of the articulator about its intercondylar hinge axis from a rest position so recorded, should bring the teeth into true centric occlusion and reveal mandibular displacement or occlusal disharmony if present. In such work, use of an articulator which permits a retrusive movement of the condyles is advantageous in order to demonstrate the abnormal.

6. In the diagnosis of malocclusion preparatory to orthodontic treatment, use is still made of the customary methods which endeavor to distinguish local from general factors and to evaluate the contributions of heredity and environment. Similarly, individual tooth irregularities, facial harmony and proportion, soft tissue placement, and general and facial skeletal development are given close study as in the past. Analysis and diagnosis of abnormalities in the basal bone of the jaws and in the facial and cranial skeleton as a whole have, however, been rendered much more exact by the use of cephalometric roentgenographic examination. Although this in itself is a modern development of the earlier static method of analysis, it deserves to be included in any discussion of the functional analysis of occlusion because it similarly directs attention to the whole masticating mechanism rather than to the teeth individually or collectively.

7. In actual orthodontic treatment of malocclusion, the influence of the functional concept has been considerable since errors in treatment necessarily follow errors in diagnosis which tend to be frequent in its absence. For example, it is now possible to distinguish in terms of the dimension of the free-way space, between a deep anterior overbite due to overeruption of the anterior teeth, and one which is due to undereruption of the posterior teeth.

It is known also that to make a partial denture without a record or at least an inspection of the rest position is to invite failure, since masticatory function of many partially edentulous mouths is of necessity deranged in some degree. The occurrence of mandibular displacement or dysfunction is nowhere more evident than in immediate denture prosthesis in which it has been customary to relate casts by inspection or by a fully closed wax record of the occlusion as it might be indicated by the relations of malposed and mutilated teeth. That the final occlusion of immediate dentures is so frequently less perfect than might be expected is sometimes due, we believe, to failure to record a true relaxed centric relation of the jaws, uninfluenced by the guidance of an existing functional malocclusion.

In orthodontia, the functional concept includes the idea of masticatory efficiency and periodontal integrity as well as evenly arranged teeth and good looks. Orthodontists are no longer satisfied with a beautiful face in the presence of a locked occlusion which is not only inefficient in mastication, but may lead in later years to periodontal destruction, temporomandibular joint dysfunction, or other pathologic changes.

A PATTERN OF CENTRIC OCCLUSION

J. C. Westbrook, Jr., D.D.S., Birmingham, Ala.

IDEAL occlusion might be defined as the state of occlusion in which the maximum number of teeth make contact simultaneously in centric relation, and in such manner as to enable the contacting planes to remain in occlusion over the widest possible range in the various excursive movements of the mandible.

There is a great deal of latitude in Nature's tolerance in the approach to this ideal state, so that at times dentists see mouths in which the periodontal condition is much better or much worse than would be expected from a consideration of the state of occlusion. However, these are the exceptions rather than the rule.

In attempting to correct faulty occlusion it is well to bear in mind the objectives and decide how nearly the ideal can be approached and what compromise may be allowed, so that the resistance of the periodontium will be equal to the stresses. The purpose is threefold: first, to establish the best possible masticatory apparatus for the general welfare of the patient; second, to achieve a balance sufficiently good to protect and stimulate the periodontium, and third, to improve the appearance of the mouth, if possible.

Before any reshaping is done, a complete examination should be made, including full mouth roentgenograms, in order to determine the condition of the periodontal tissues, the length and shape of the roots and the quality of the bone structure. Naturally, the weaker the support the more nearly perfect should be the occlusion to minimize the strain on the tissues.

The first phase of the clinical examination, after consideration of the supporting structures, is a careful study of the occlusion in centric relation. First, the patient should be asked to tap the teeth together rapidly, while the dentist applies light pressure against the chin and listens to the sound. If it is sharp and clean, centric occlusion is probably reasonably good, or the patient has found a relation which is unusually good in function. A muffled or chattering sound is an indication of premature contact of some of the cusps.

To test further, the patient is asked to close his jaws and then attempt to retrude the mandible, with teeth touching. If this can be accomplished there will be a marked opening of the jaws, a definite indication that the original closure was an acquired rather than a true centric relation.

Another and very reliable method of checking centric relation is to take a wax bite of the posterior teeth only, with the mandible retruded. Then the anterior relation can be checked visually during and after treatment, by comparing it with the relation in the original closure. The patient is instructed to close the jaws until the first teeth make contact, and then stop. The wax bite can be checked by holding it to the light. The premature contacts, or, rather, the first contact, will show as the thinnest. If the wax has been bitten through, it is best to take another wax bite, for it is probable that too much pressure was exerted, allowing the mandible to come forward and engage cusps other than those that are in contact in centric relation. This bite can be used

both as a check bite and also to mount record models.

An important step to consider at this time is the relative height of the anterior and the posterior teeth in the lateral and protrusive relation. For example, if the only teeth making contact in left lateral relation are the cuspids, it would be unwise to shorten the posterior teeth. However, if the patient has an open bite, the cusps of the posterior teeth can usually be shortened considerably.

If the patient is somewhat apprehensive about allowing grinding of the enamel, he can be assured that this is a way of compensating for lack of coarse food which would cause much normal wear. Also, the teeth are being reshaped, not ground down, so that the planes or cusps will function normally.

The key to the success of this procedure is to establish a definite pattern of occlusion in centric relation. This is done in such a manner as to have ball and plane contacts which are harmonious throughout the mouth. The ball contact is always toward the end of the cusp. It makes contact with the plane of the opposing cusp at the base of the plane, and glides on it in an excursive movement of the mandible. The tip of the cusp usually is not allowed to make contact in centric relation, for several reasons. First, if it does not make contact the wear of the functioning surfaces of the teeth is more apt to be uniform; second, the carbon markings are much less confusing when the corrections are made in lateral and protrusive movements; third, it reduces the force applied to the periodontium in function, and fourth, it allows for shortening cusps without closing the bite.

Premature contacts in centric relation are readily discerned by means of the carbon markings as well as by sound and appearance. With such premature contacts there can be no ball and plane function in lateral movement because most of the contacting areas are immediately disengaged when a lateral excursion is attempted. Most of these premature contacts are on the distal inclines of the lower and the mesial inclines of the upper teeth. They force the mandible forward, putting tremendous mesial and distal stress on the alveolar bone, which is ill designed to withstand this type of stress (Fig. 1, above).

In correcting this condition, one of the most important things to consider is the elimination of food packs which are caused not only by bad contacts, but also by uneven marginal ridges, movement of the teeth under pressure and wedging of food between the teeth by the action of the opposing cusps.

There can be no definite rules laid down regarding the cusp relations because they must be influenced by alignment of the teeth. However, in a normal (orthodontic) occlusion, the most important functioning cusps are the mesiolingual cusps of the upper molars working in the fossae of their corresponding lower molars. Thus the plane contacts which should function here, for instance in left lateral movement, would be the lingual planes of the upper buccal cusps of the left side, the lingual planes of the lower buccal cusps of the opposite side and the buccal planes of the lower lingual cusps of the left side. In this instance, the ball contacts would be on the buccal and lingual planes of the upper lingual cusps and the buccal planes of the lower buccal cusps of the left side, the most important being on the upper mesiolingual cusp. It is possible for the ball and plane contacts here described to be reversed, and this can be determined by an examination of the carbon markings made is centric relation. The plane contact is toward the base of the cusp (toward the fossa). This is readily understood because in order to function as a plane the centric contact must be at the base of the cusp, with the glide of the ball contact along this plane toward the tip of the cusp (Fig. 1, below).

If there is plane-to-plane contact,

which is true of normal well worn dentitions, and if there is no evidence of a change in the periodontal structures, and no detectable mobility, centric interference, temporomandibular discomfort or food impaction, there is probably no need for correction. This type of occlusion, where there is marked attrition, is found in most skulls of primitive, uncivilized races and is caused by vigorous mastication of coarse foods. Today, it is rarely seen except in rural areas and in those who chew tobacco.

In a periodontal practice, one or more of these conditions is usually found when there is plane-to-plane contact, so it is necessary to compensate for this lack of balanced wear. In a plane-to-plane contact with deep overbite, where posterior cusps are not to be shortened, the ball contact is created by grinding material from the fossa or base of the cusp toward the end of the cusp, leaving the carbon marking intact where the ball contact is desired. Of course, as mentioned before, the mouth has been checked for both lateral and protrusive relations in order to determine the position of the ball contact. In an open bite, unless there is marked wear of the cusps, the grinding may be from the end of the cusp of the molars, though care should be taken not to cut past the centric carbon marking where the ball contact is desired. The size of the ball contact is determined by the degree of mobility of the tooth; the greater the mobility, the smaller the contacting area. The ball contacts naturally wear faster than the planes, and their wear causes a closing of the bite. If the

Fig. 1.—Above: Centric contacts before correction. Below: Centric contacts after correction

Fig. 2.—Left: Centric relation with no intercuspation. Right: Centric relation after correction

teeth are reasonably firm, the ball contacts may be larger.

It is most desirable, but not always possible without reconstruction or orthodontic treatment, to have reciprocal centric contacts of the posterior teeth, to prevent all the force from being applied either buccally or lingually. If, for example, the only centric contacts of a lower second molar are on the buccal inclines of the buccal and lingual cusps, the pressure is all directed linguovertically and as such is apt to cause mobility. This, in turn, prevents normal wear, so a vicious cycle is created: less wear, more mobility; more mobility, less wear. The tooth should be checked in lateral occlusion with articulating paper to determine the functioning planes and furnish a guide as to where the ball and plane centric contacts are too be established, if possible. The carbon is removed and another check is made with the articulating paper in centric relation. Since there is mobility, and since a mobile tooth is more difficult to take out of occlusion (which should not be done except in extreme cases), the marks may be ground slightly, stopping the movement of the tooth in centric relation and probably establishing the reciprocal contact on the lingual incline of the buccal cusp. If centric occlusion is good, the ball and plane contact pattern is usually established rather easily, for the proper contacting areas are usually making contact, or are potentially doing so, as soon as the premature contacts of the mobile teeth are relieved.

If there are premature contacts but the teeth are firm, there is a forward shifting of the mandible on full closure, resulting in a condition in which there is no possibility of normal occlusion in true centric jaw relation. This can be slight, as in the case of extruded teeth, or it can be extreme, as in the type which McLean describes as eccentric intercuspation. This means that there is an intercuspation of the upper and lower teeth and the occlusion looks normal, but the jaw relation is actually eccentric. When the mandible is retruded to the normal centric jaw relation, there is no intercuspation and consequently no function in that position (Fig. 2). Centric relation has been defined as the most retruded position of the mandible from which lateral excursions can be made. Eccentric intercuspation is nearly always traumatogenic because there is a conflict between the arbitrary, protrusive, chewing position and the normal muscular action which is directed toward closing the jaws in centric relation. The jaws do not function directly in the arbitrary protrusive

position, for the muscles of mastication are pulling the jaws retrusively from that position, so that the patient is working between the two. In the extreme cases, the bite may be so open in centric relation that there can be no physiologic rest position of the mandible. This causes a great deal of mesiodistal stress, more or less constantly, the teeth striking in swallowing, talking and reclining. (Fig. 3, above). To make matters worse, this patient is usually afflicted with bruxism.

In the correction of false centric relation, there are times when both orthodontic treatment and reconstruction are needed, but there are few such occlusions which can not be materially aided, if not entirely corrected, by reshaping the teeth. Here the ball and plane pattern is most helpful because there can be no definite areas designated which should or should not be ground. If the dentist keeps in mind the centric pattern toward which he is working, the areas to be ground can be determined as the work progresses.

S. W. Brown has made a plate that he calls an "analyzer," which is very effective in demonstrating the first contacting area in centric occlusion. A bite is taken and models are mounted on this plate.

The only registration which is accepted as a true contact is that area in which the carbon is erased by repeating the closure used when the carbon paper was in place. Make sure the patient can close in centric relation. Even though it is difficult at first, he may be guided from a slightly open position to an almost closed one, and then the dentist may tap the teeth together gently but rapidly. If this is accomplished satisfactorily with the mandible retruded, the dentist should test again with articulating paper, preferably with a large sheet of paper covering both right and left sides of the arch. The premature contact area or areas marked will be found on the distal in-

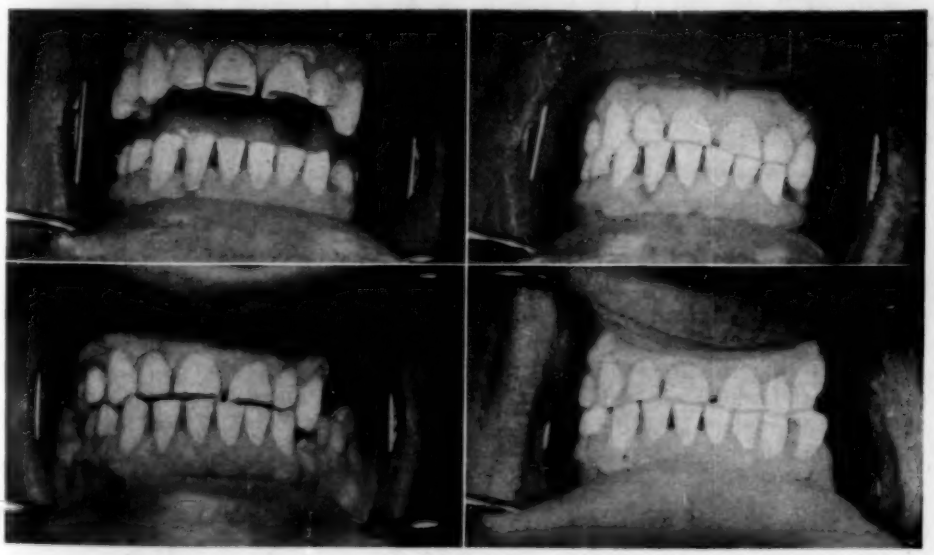

Fig. 3.—Above left: Centric relation with premature contact of lower second molar with upper extruded third molar. Above right: Eccentric or convenience relation. Below left: Premature anterior contact after relief of molar contact. Below right: End-to-end bite after correction

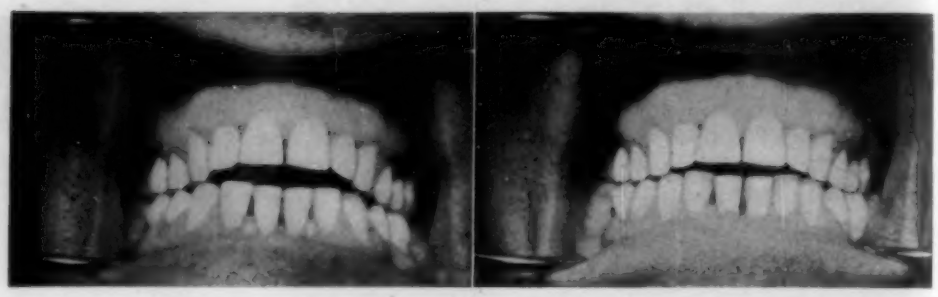

Fig. 4.—Left: Open bite. Only bicuspids are in contact in centric relation. Right: After closing bite. Both pairs of cuspids are now in contact in centric relation

clines of the lower and mesial inclines of the upper teeth.

If the premature contacts are in the anterior region, the acquired relation will have the appearance of Class III malocclusion, with the lower anterior teeth labial to the upper, at least where there are premature contacts. It is usually desirable to shorten these teeth as much as possible, which will sometimes establish an end-to-end bite in centric relation (Fig. 3, below). If this is not accomplished after shortening the teeth as much as practical, further grinding can be done on the incisal half of the carbon markings on both upper and lower teeth. This procedure is repeated with such modifications as necessary because of restorations, weak incisal angles, esthetics, proximity to pulp and so forth, until the patient can close easily in centric relation with a little more pressure, without a shifting of the mandible forward, and with a fairly sharp, clean sound.

If the premature contacts are on the posterior teeth, this procedure is not so satisfactory because it will possibly shorten some cusps which are needed for balance in either centric relation or the various excursive movements, particularly the lateral. It is important to preserve the cusps, both upper and lower, which make contact with the fossae of the opposing teeth. A safer rule is to grind the mark which is toward the base of the cusp or in the fossa, except that those cusps which make contact in the interproximal area may be ground after shaping the marginal ridges and creating escape grooves. It is, of course, absolutely necessary that the mandible be in the retrusive position and that only contacts in this position be ground. As in anterior premature contact, grinding is continued until the patient can close in centric relation easily and without forward shift of the mandible.

At this stage, in both previously described types, the mouth is checked in lateral protrusive movements without the articulating paper to note the relative cusp heights. If, in the first movement of the protrusive thrust, the jaws close on an incline and then open in retrusive position, there is need for further closing in centric relation in order that the jaws may function in protrusive movements. This, however, is done by checking with the articulating paper in both lateral positions. Here the grinding is done on planes except where the ball contact rides over the height of the cusp. This ball contact is ground only if it makes contact with the plane in centric relation.

Much care should be taken here for this is the most crucial stage. The bite is being closed only in centric and lateral relations, and the centric contacts are being placed in such a way that the most nearly ideal balance can be obtained

throughout the widest possible range. The carbon marks should be removed frequently and contacts should be rechecked in centric position each time, preferably with red articulating paper or typewriter ribbon, before lateral movements are checked with the blue. This, if possible, should be continued until the centric position is at least as far closed as any other position, so that the jaws can function easily in that position.

There are times when it is necessary to close a bite in order to get a sufficient number of teeth in contact in centric relation to relieve strain on teeth with excessive mobility. This is particularly true when the cuspids are not in contact in centric relation. A patient with an open bite is shown in Figure 4.

It might be well to bear in mind that first the centric contacts should be placed in as nearly ideal a position as possible when the bite is closed sufficiently in centric or when the proper centric relation is established. Secondly, the grinding is done on the mesial side of the carbon marking of the lower and the distal side of the markings of the upper teeth in this phase, as a general rule, both on the ball and on the plane.

At this time there should be reasonably good balance in lateral excursions as well as in centric relation. There are few patients who will not get along very satisfactorily if the centric occlusion is good and if the lateral balance is good within 2 or 3 mm. of centric position on both sides.

If the bite has closed, it is seldom practical to attempt a balance in the extreme positions, either lateral or protrusive, but it is beneficial to have the planes rather straight to the end of the cusp or until that particular cusp is out of contact. It is also best to have a smooth transfer of pressure from one cusp to another. For example, if the ball contact of the lower cuspid rides over the end of the upper cuspid and then the contact is transferred to the lateral incisor, it should be with a smooth glide, not riding over the cuspid and coming down with a bump on the incisor. This can be accomplished by grinding the plane of the upper cuspid so that there is a straight incline to the end of that plane, not riding over the top of the cusp.

Protrusive balance is not as necessary as lateral balance, but it is well to check this, particularly close to centric relation, having as many planes of the upper teeth in contact as long as possible. The same rules of ball and plane balance apply here.—*1418 Comer Building.*

▲

Preoperative Purging Not Always Wise.—It was formerly common medical practice to use a laxative or purgative routinely before surgical operations. It is now recognized that such procedures are not always necessary. Sometimes they are definitely undesirable. In the case of an infected appendix, a laxative may spread infection in the intestines. Laxatives produce excessive intestinal gas and may weaken the patient if their action is drastic. They may remove too much fluid and digested, but not yet absorbed, food which would be helpful to the patient during the immediate postoperative period in which no food or liquids can be taken. Consequently, surgeons now give laxatives only to those patients who show definite need for such treatment.—*Austin E. Smith, The Drugs You Use. New York: The Revere Publishing Company, 1948, p. 67.*

A SURVEY OF DENTAL ALLOYS

Joseph R. Lane, Cambridge, Mass.

WIDE use is made of several classes of alloys in dentistry. An attempt will be made here to describe the requirements for each of the alloys, and their compositions and behavior. The field can conveniently be divided into these groups:

1. Amalgams
2. Precious-metal alloys
3. Cobalt and chrome alloys
4. Stainless steels
5. Other metals or alloys for fillings or dentures

Amalgams

No other material is so universally and successfully employed in restoring carious teeth to a state of usefulness as is dental amalgam. Besides forming such a large proportion of the fillings, the number of amalgam restorations made annually is tremendous. The office of the Surgeon General stated that 68,170,326 permanent fillings were inserted by Army dentists from December 7, 1941, to September 1, 1945, and most of them were of amalgam.[1]

Historically, amalgams were first introduced in Europe in 1826 (under the name of "silver pastes") and in America in 1833. Partly because of their inferior and undependable performance, but largely because they were first used by charlatans, the adoption of amalgams by the dental profession was slow. What has been called an "amalgam war" raged, beginning in 1845. The American Society of Dental Surgeons passed a resolution in 1845 which reads:

Resolved, That any member of the Society who shall hereafter refuse to sign a certificate pledging himself not to use any amalgam, and, moreover, protesting against its use, under any circumstance, in dental practice, shall be expelled from the Society.

Later, the courageous stand of a few recognized members of the dental profession, helped by improved alloys, paved the way for their general use.

The advantages of amalgam as a filling material (due to Gabel) are[2] (1) ease of manipulation, (2) adaptability to large cavities not suited for an inlay, (3) minimum loss of tooth structure, (4) economy, (5) adaptation to cavity walls, (6) insolubility in oral fluids, (7) lack of hardship to patient during insertion and (8) high crushing strength.

Disadvantages of amalgam are (1) poor color, (2) high thermal conductivity, (3) high coefficient of thermal expansion and (4) low tensile and shear strength.

In order to give satisfaction to both the patient and the dentist, an amalgam must possess these properties: (1) ease of manipulation, (2) proper dimensional behavior (slight expansion), (3) limited flow (just sufficient to permit burnishing of margins), (4) sufficient strength to withstand the stresses of mastication and (5) chemical stability (resistance to oral fluids).

Such a combination of properties may be attained only through careful com-

From the Department of Metallurgy, Massachusetts Institute of Technology.

1. Roper, L. H., Restorations With Amalgam in the Army: an Evaluation and Analysis. *J.A.D.A.* 34:443 (April 1) 1947.

2. Coven, E. M., Review of Amalgam Technique. *Penn. D. J.* 47:29 (May) 1944.

pounding of the alloy. To investigate and test dental materials, the American Dental Association has maintained a fellowship at the U. S. Bureau of Standards since 1928. Here dental materials are examined, and standards governing approval by the A.D.A. are established. Present specification U.A. 451a(2) was announced in 1937. It states that (1) dental amalgam alloy shall contain a minimum of 65 per cent silver and 25 per cent tin, and a maximum of 6 per cent copper and 2 per cent zinc, (2) twenty-four hours after amalgamation, the length shall have increased between 3 and 13 microns per centimeter, and (3) flow shall be less than 4 per cent in a standardized test.

In an examination at the R.A.F. Institute of Aviation Medicine, the compositions of some commercially available and representative alloys were found to be as listed in Table 1.[3] All these alloys apparently meet A.D.A. specifications, although not all of them appear on the A.D.A. list of certified dental materials. In addition, the starred alloys comply with requirements of the Dental Investigating Committee of the Dental Board of the United Kingdom. Included in these later specifications are these requirements:

1. Particles should pass completely through a 60 mesh sieve.

2. Filings are to be aged for six hours *in vacuo* at 100 C.

3. The composition is to lie within the following limits:

a. 25.7 ± 0.3 per cent tin.

b. Copper, up to 5 per cent, may replace the silver content, provided that for every 1 per cent of copper the tin content is increased by about 0.1 per cent. If no copper is added, the lower limit for tin is used.

c. An equal weight of zinc may replace silver, but the amount present should not be above one-third that of copper up to 5 per cent copper.

4. Mercury is to be mixed with the alloy in the ratio of 1.75 to 1.

5. The method of mixing is specified.

6. When setting at mouth temperature (37 C.) the amalgam should expand, the total expansion not to exceed 4 microns. The method of measuring the expansion is specified.

Referring to the silver-tin binary diagram (Fig. 1), and neglecting the minor constituents, it is seen that all of the alloys have a composition close to Ag_3Sn. Under the microscope, Ag_3Sn crystal can be seen imbedded in an exceedingly fine granular eutectic of Ag_3Sn and Sn.[4] The addition of mercury converts the intermetallic compound of silver and tin to an intermetallic compound of silver and mercury.

The probable reaction can be shown by the equation[5-7]

$$7Ag_3Sn + 29\,Hg \rightarrow 7Ag_3Hg_4 + Sn_7Hg$$

Because equilibrium is never attained, the reaction is not this simple. The only component of the alloy which is involved is the Ag_3Sn. When the alloy is triturated with mercury, the first reaction is the absorption of mercury by the Ag_3Sn particles, forming a solid solution on the surface. This is designated as the $beta_1$ phase. Simultaneously a tin-mercury phase, designated as $gamma_2$, separates out from the solid solution in small proportions. The probable formula of

3. Harvey, Warren, Some Recent Research Into Dental Amalgams at the R.A.F. Institute of Aviation Medicine, Farnborough, Hants. *Brit. D. J.* 81:245 (Oct. 18) 1946.

4. Harper, W. E., The Significance to Dentists of Physico-Chemical Changes Incidental to Amalgamation and the Hardening of Dental Amalgams. *J.A.D.A.* 12:34 (Jan.) 1925.

5. Troiano, A. R., An X-Ray Study of Dental Amalgams. *J. Inst. Metals* 63:247 (Aug.) 1938.

6. Gayler, Marie, Some Factors Affecting the Setting of a Dental Amalgam. *Brit. D. J.* 54:269 (March 15) 1933; 56:605 (June 15) 1934; 58:145 (Feb. 15) 1935; 59:245 (Sept. 2) 1935; 60:605 (June 15) 1936; 61:11 (July 1) 1936.

7. Phillips, R. W., Dental Amalgams; Reaction Involving Measurement of Minute Dimensional Change. *J. Chem. Educ.* 22:117 (March) 1945.

Table 1.—Composition of some representative dental amalgam alloys

No.	Manufacturer	Name	Per cent of					Alloy: mercury ratio
			Silver	Tin	Copper	Zinc	Gold	
3	Associated Products, Ltd.	Kemdent (No. 1) Super Silver	67.5	28.6	2.86	.....	.....	.....
4	Associated Products, Ltd.	Kemdent Submarine	68.0	28.4	2.86	.....	.....	.....
5	Associated Products, Ltd.	Kemdent Super Silver	67.4	29.0	2.88	.....	.....	.....
10	Amalgamated Dental Co., Ltd.	C. A. S. Slow	67.4	26.8	4.38	1.17	.....	.....
11	Amalgamated Dental Co., Ltd.	C. A. S. Rapid	66.9	26.5	4.42	1.22	.....	.....
12	Baker Platinum, Ltd.	Aristalloy	69.1	26.4	2.72	1.33	.....	1:1.6-2
13*	Baker Platinum, Ltd.	7	68.1	25.5	4.88	1.02	.....	.....
14	Black	Verax	67.1	26.4	4.30	1.54	.....	1:2
15	Browning	Silverseal 68%	67.9	24.8	5.84	1.13	.....	6:8
16	Calk (De Trey)	Twentieth Century	67.0	26.5	4.54	1.23	.....	5:7
21*	Cleveland Dent. Mfg. Co.	Crandall's Non Zinc	69.0	25.6	4.80	0.21	.....	12:10
22	Davis Schottlander & Davis	Criterion	66.2	26.4	5.28	1.83	.....	9:11 or 7:9
24	Dental Mfg. Co.	Fellowship	67.5	26.3	4.90	0.51	.....	5:9
27	Dental Fillings, Ltd.	Silver Capella 67	67.6	28.6	2.80	trace	.....	.....
31	De Trey	Solila	66.6	27.1	4.40	1.54	.....	5:6 or 7
32*	De Trey	37	68.5	25.9	4.64	0.20	.....	5:7 or 9
34	Elliot & Co.	Optimus	67.6	26.3	5.04	0.61	.....	.....
40	J. M. Ney Co.	Ney-Aloy	65.9	27.8	4.42	1.13	trace	5:5½
44	Porro	Gold	69.4	25.8	0.12	1.02	4.06	7:9
46*	Smith	Certified	68.2	25.7	4.94	0.10	.....	.....
47	Tullock's	Gold Medium Set	66.3	28.6	.....	0.98	4.02	Abt. 1:1
48	Tullock's	Gold Black's No. 2 Mod.	69.8	25.0	.....	1.03	3.90	Abt. 1:1
49	Tullock's	Silver	66.9	27.4	4.30	1.03	.....	6:7
54	S. S. White Co.	True Dentalloy	69.5	25.4	2.32	1.85	.....	5:7-8
55	S. S. White Co.	True Dentalloy Quick Set	70.0	24.9	2.40	1.95	.....	5:7-8
56	S. S. White Co.	True Dentalloy Slow Set	69.7	25.5	2.44	1.85	.....	5:7-8
58	E. R. S. Brewster	Brewster Quick Set	66.1	28.2	4.9	0.8	0.02	.....
60	J. T. Dee	Dee	65.2	29.0	4.8	1.0	0.04	.....
63	N. K. Garhart	Royal	66.7	28.2	4.6	0.5	.....	.....
64	Goldsmith Bros.	Banner	67.0	27.3	4.8	1.9	0.04	.....
67	Minimax Co.	Minimax 178	67.4	26.9	4.7	1.0	0.01	.....
68	Minimax Co.	Minimax 183	66.8	28.2	3.9	1.1	.....	.....
71	Mynol Chemical Co.	Mynol	67.0	27.3	4.7	1.0	.....	.....
72	Stratford Cookson	S. C.	66.6	27.4	5.1	0.9	.....	.....
73	Trucast D. M. Co.	Trucast	67.6	26.8	5.5	0.1	0.2	.....

*Complies with requirements of the Dental Investigating Committee of the Dental Board of the United Kingdom. Analyses of alloys 3 to 56 were made by the Metallurgy Division, Materials Department, Royal Aircraft Establishment, Farnsborough. Alloys 58 to 73 were analyzed by N. O. Taylor.

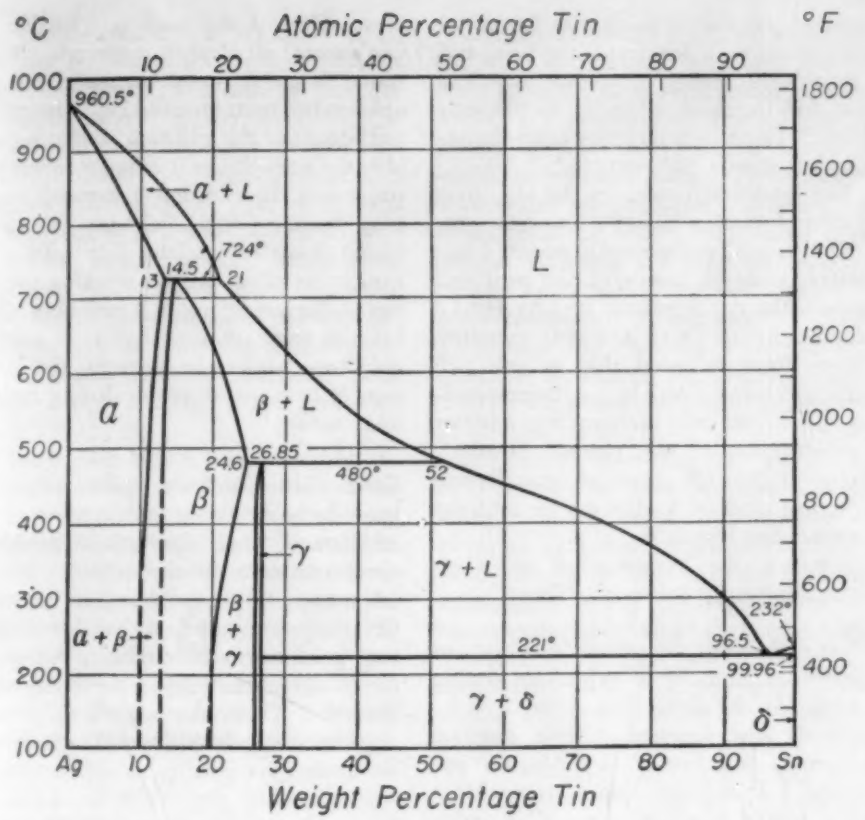

Fig. 1.—Silver-tin equilibrium diagram. (Reproduced from an article by D. Harker in 1948 Metals Handbook)

$gamma_2$ is Sn_7Hg or Sn_8Hg. The initial reaction is:

$$Ag_3Sn + Hg \rightarrow beta_1 + gamma_2$$

Owing to the absorption of mercury, a contraction of 2 to 4 microns occurs, mostly during trituration and packing. Not all the Ag_3Sn takes part in the first stage of the reaction. The second stage involves unattacked Ag_3Sn and $gamma_2$. Ideally it should take place immediately after condensing in the prepared cavity.

$$Ag_3Sn + gamma_2 \rightarrow gamma_1$$

$Gamma_1$ has the composition Ag_3Hg_4 or possibly Ag_5Hg_8, and may also contain tin. Since the reactions never go to completion (this is not desired, for excessive shrinkage would result), they might best be indicated thus:

$$Ag_3Sn + Hg \rightarrow beta_1 + gamma_2 + Ag_3Sn$$
$$Ag_3Sn + beta_1 \rightarrow gamma_2 + beta_1 + gamma_1 + Ag_3Sn$$

Troiano claims that the final expansion is due to the dendritic growth of $gamma_1$ during crystallization. The setting of the amalgam is a result of the raising of the freezing point, due to the change in composition, to above mouth (or room) temperature. The lack of equilibrium may explain most of the well-known "peculiarities" of dental amalgams. The tin seems to serve mainly a temporary and

transient purpose; it facilitates the initial amalgamation, it lubricates the mix, and it retards the setting to provide sufficient time for insertion while it is properly plastic.[4] The excess mercury exuded contains less than 1 per cent tin.[8]

The lattice structure of Ag_3Hg_4 may be that of gamma brass (a low-symmetry cubic electron compound), possibly imperfect, with 46 atoms in the unit cell against the 52 required in (Ag_5Hg_8),[4] which contains 25.14 per cent mercury. Others have believed that a unit cell with 50 atoms, $(Ag_2Hg_3)_{10}$, corresponding to 26.4 per cent mercury was a better representation of the phase.[9] Strader[10] discussed the effect of an equilibrium structure and of variations in mercury content. See Figure 2.

Altering the composition of silver amalgam has the following effects:

Silver.—Raising the silver content increases the amount of expansion during setting. At the same time strength is increased, flow lessened, setting reaction hastened, and color and luster improved.[11] It is interesting to note that a given weight of a high-silver alloy makes a considerably larger filling than the same weight of a low-silver alloy, because it unites with more mercury (which is comparatively cheap).[12]

Tin.—Increasing the proportion of tin decreases the amount of expansion or causes contraction of the amalgam. Also, the setting reaction is slowed, strength drops off and flow is increased, amalgamation is facilitated, and the resultant alloy is whitened. Excessive tin yields a mass from which it is very difficult to remove excess mercury.[4,11]

Copper.—This element slows down the amalgamation reaction but hastens setting time. Raising the copper content increases strength, decreases flow, imparts marginal strength, and stabilizes amalgamating characteristics.[11,13,14]

Zinc.—One of the earliest scientific investigators of dental materials, Black, stated that zinc was detrimental, but this opinion has been reversed.[15-17] The principal benefit of the addition of zinc is probably the smoothness it imparts to working properties. In addition, increased toughness, tenacity and stickiness (to cavity walls) have been claimed.[11,14] In addition to its effect on the working properties of the amalgam, it is probably added for the same reason that it is used in gold-base alloys—to prevent the inclusion of base metal oxides during melting and casting.[13]

Gold.—Little definite information appears to be available on the effect of the addition of small amounts of gold to a silver amalgam. Black has stated that no advantage is obtained by its presence. On the other hand, it has been stated that gold increases toughness and assists the amalgam in hugging the cavity at the margin.[11] From the analyses shown, it appears that gold is sometimes present as an impurity.

Mercury.—It is a commonly held opinion

8. Gray, A. W., Volume Changes Accompanying Solution, Chemical Combination and Crystallization in Amalgams. *J. Inst. Metals* 29:139, 1923.

9. Hudson, Douglas, On the Density, Thixotropy and Setting of Heterogeneous Silver Amalgam. *Metallurgia* 29:207 (Feb.) 1944.

10. Strader, K. H., Amalgam Alloy: Its Heat Treatment, Flow, Mercury Content and Distribution of Dimensional Change. *J.A.D.A.* 38:602 (May) 1949.

11. Cowling, Thomas, *Dental Amalgams.* The Canadian Dental Research Foundation Bulletin No. 13. Toronto, Canada: University of Toronto Press, April 1935.

12. Gray, A. W., Metallographic Phenomena Observed in Amalgams. *J. Nat. D. A.* 6:513 (June) 1919; 6:909 (October) 1919.

13. Skinner, E. W., *The Science of Dental Materials.* Philadelphia; W. B. Saunders Co., 1940.

14. Worner, H. K., and Anderson, J. S., The Influence of Some Manufacturing Variables on the Properties of Dental Amalgams. *Austral. J. Den.* 43:269 (Aug.) 1939.

15. Harder, O. E., *Modern Dental Metallography.* Minneapolis: Burgess-Roseberry Co., 1930.

16. Gray, A. W., Transition Phenomena in Amalgams. *J. Nat. D. A.* 8:196 (March) 1921. Discussion 8:491 (June) 1921.

17. Miller, E. C., Clinical Factors in the Use of Amalgam. *J.A.D.A.* 34:820 (June 15) 1947.

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that excess mercury is removed when amalgam is condensed. However, it has been found that as the ratio of mercury to alloy is increased, the percentage of residual mercury increases proportionately.[18] Because the crushing strength decreases (an average of 7 per cent) with excess mercury, it is worth-while to proportion the two accurately. Many other investigators have stated that a deficiency of mercury is more harmful than an excess, resulting in poor working properties, a coarse structure with a poor surface and prolonged changes in volume.[1,10-12,17]

A large part of the early scientific investigation was devoted to a study of the effect of variables on the expansion of amalgams during setting. It was found that volume changes were discontinuous with time and were affected by the composition and also by nearly every step of the operation. According to Gray,[8] the first contraction is due to the solution of the alloy in the mercury and the formation of Ag_2Hg_4. Crystallization of this compound follows quickly and is accompanied by an expansion. However, because solidification occurs before all of the Ag_3Sn and Hg are able to react, a second, smaller contraction occurs later. This is because of the formation of additional Ag_2Hg_4 by the diffusion of the remaining mercury into the metal particles, which now have an alloy core but are covered with a layer of silver-mercury compound. Crystallization of this "secondary" Ag_2Hg_4 causes a final small expansion. Because of the necessity for, and the slowness of, diffusion, the final size and ultimate hardness are not attained until after a period of 5 to 24 hours. To allow sufficient working time, seven minutes has been estimated as a minimum setting time.[3] On the other hand, it is desirable for the amalgam to have attained nearly its final hardness after three or three and a half hours so that the eating of a subsequent meal will not cause undue flow.

One other cause of amalgam expansion has been determined. Moisture and sodium chloride have been found to react with zinc, releasing hydrogen gas.[19-21] Hydrogen was not detected in alloys which do not contain zinc. Three sources of moisture are the hand ("palming" of amalgam is no longer considered good practice[22]), saliva and solid carbon dioxide (used for packing large batches of triturated amalgam in clinics).[23, 24] Thus the form of the expansion curves in separable into several components which progress simultaneously and successively at different rates.

The expansion of amalgam, along with other properties, can be controlled by changes in any of a large number of variables. It has been pointed out that there may be at least thirteen variables in amalgam technic.[25] Under control of the manufacturer are (1) composition, (2) cutting (particle size, particle size distribution, particle shape) and (3) annealing. Conditions under the control of the dentist are (1) alloy-mercury ratio, (2) trituration time, (3) grinding pressure, (4) packing pressure, (5) presence or absence of moisture and (6) time interval between mulling and packing.

Several of these factors are related. Thus, increased grinding pressure, or longer trituration time, or great packing

18. Phillips, R. W., and Boyd, D. A., Importance of the Mercury-Alloy Ratio to the Amalgam Filling. *J.A.D.A.* 34:451 (April 1) 1947.

19. Sweeney, J. T., Manipulation of Amalgam to Prevent Excessive Distortion and Corrosion. *J.A.D.A.* 31:375 (March 1) 1944.

20. Souder, Wilmer, and Paffenbarger, G. C., *Physical Properties of Dental Materials*. Circular of the National Bureau of Standards C433. Washington, D. C.: U. S. Government Printing Office.

21. Research Commission, Excessive Expansion of Amalgam. *J.A.D.A.* 29:292 (Feb.) 1942.

22. Research Commission, American Dental Association, Effects of Contamination of Amalgam With Moisture. *J.A.D.A.* 37:239 (Aug.) 1948.

23. McCauley, C. M., Indictment of Contaminated Amalgam. *J. South. California D. A.* 13:12 (July) 1946.

24. McCauley, C. M., Some Interesting Things About Amalgam. *J. South. California D. A.* 10:20 (Oct.) 1943.

25. Ward, Peyton, and Scott, New Concepts of Mercury Content in Amalgams. *J. D. Res.* 16:316, 1937.

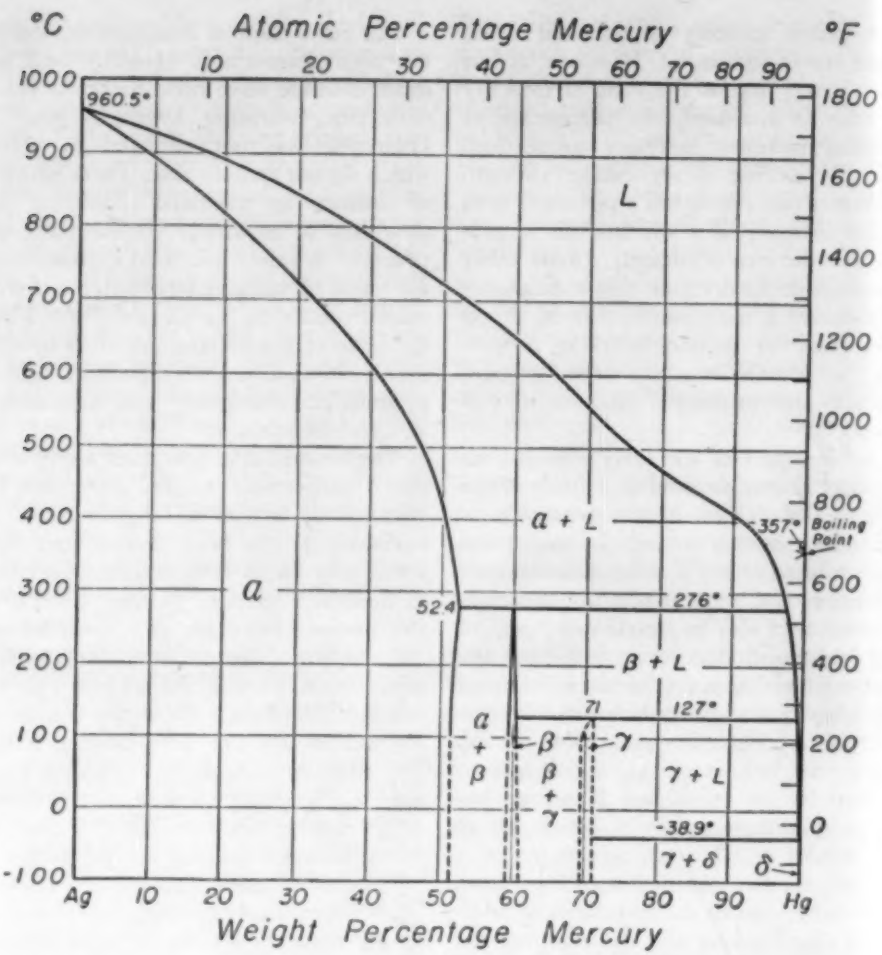

Fig. 2.—Silver-mercury equilibrium diagram. (Reproduced from an article by W. Earl Lindlief in 1948 Metals Handbook)

pressure, all have the same effect as the use of a finer-grained alloy; they all promote more intimate contact of the alloy and mercury and result in more nearly complete reaction between the two. Expansion decreases as the completion of the reaction is promoted; hence for a constant packing pressure, the grinding time or pressure should not be too great, nor the particle size of the alloy too small. On the other hand, inadequate mixing will yield a mass which is not sufficiently plastic for satisfactory handling, and which will take a longer time to reach its final dimensions.

Of all the restorative materials employed in dentistry, amalgam is not only the most widely used but also the most susceptible to the technic employed. Amalgam is extremely sensitive to manipulative abuse. Because this is the case, it is important to limit the variables insofar as is possible. The mercury-amalgam ratio should be carefully meas-

ured. Also, mechanical amalgamating devices are a step in the right direction. Jarabak[26] and Smith[27] found that with a decrease in particle size, the effect of variations in trituration or in condensation pressure had a smaller effect on dimensional changes. Hence it appears that, within limits, amalgam alloy with smaller particle size should be favored.

To recapitulate, shrinkage or reduction of expansion is caused by overtrituration, heavy pressure during trituration, long kneading time, small particle size and deficiency of mercury. Expansion or reduction in shrinkage is caused by trituration below 68 F.,[28] short kneading time, "palming" or moisture from other sources, long wait after mulling and before packing, light packing pressure and excessive mercury left in amalgam.[3]

Some of the conclusions, such as the degree of expansion that is desirable, have been reached on the basis of laboratory tests. Clinical confirmation should always be obtained. This has been done for one phase of amalgam preparation, trituration time. Four conclusions were reached.[29]

1. Small dimensional changes due to variations in trituration time cannot be detected clinically.

2. Fillings with a flow value of 6.5 per cent gave no clinical evidence of distortion.

3. The three minute mix produced fillings with smoother and brighter surfaces, whereas the underamalgamated fillings, in general, developed an excessive tarnish.

4. With proper cavity preparation, prevention of contamination and heavy packing pressure, slight deviations from the recommended trituration time will not produce any major discrepancies.

While room for improvement of amalgams still exists, most failures of fillings can be blamed on the dentist. Plastic filling materials lend themselves to careless technic and must be handled in a definite and consistent manner if every restoration is to be successful.[18, 30] There are still some dentists who regard them as second rate, but amalgam fillings are ardently defended by careful operators.[17]

Relatively small use is made of amalgams based on copper instead of silver. The average composition is 67 per cent mercury, with the remainder copper, except for possibly very small amounts of zinc or tin.[13] Copper amalgam is used in the making of models for use in the indirect inlay technic. Dimensional changes in setting are small and probably negligible. It has been claimed that they contract,[13] or possibly expand on setting.[14]

Precious Metal Alloys

Alloys based on gold have long maintained an important place in dentistry. This is largely due to two factors: the ease with which they may be fabricated and their chemical inertness. The resistance to oral fluids is largely determined by the precious-metal content of the alloy. The mechanical properties, which influence both the manner in which denture or restoration can be made and the manner in which it will perform in the mouth, are subject to considerable control.

First, the properties of the pure metals will be listed. Next, the nature of the hardening processes will be discussed. Finally, commercial alloys will be described.

Table 2[31] gives physical and mechanical properties of gold, platinum and palladium. Although other of the platinum

26. Jarabak, J. R., Effect of Particle Size on Dimensional Change in Dental Amalgams. *J.A.D.A.* 29:593 (April) 1942.

27. Smith, Ernest A., Particle Size of Dental Amalgam Alloys. *Brit. D. J.* 86:34 (Jan. 21) 1949.

28. Worner, H. K., The Influence of Trituration Temperature on the Properties of Dental Amalgams. *Austral. J. Den.* 44:81 (March) 1940.

29. Phillips, R. W., and others, Clinical Observations on Amalgam With Known Physical Properties. Final Report. *J.A.D.A.* 32:325 (March 1) 1945.

30. Brown, R. K., Present Day Trends in Operative Dentistry. *J.A.D.A.* 30:1399 (Sept.) 1943.

31. Vines, R. F., *The Platinum Metals and Their Alloys*. New York: The International Nickel Co., Inc., 1941.

metals are used in small quantities, these three are the only precious metals used in large proportions in dental alloys.

Because the properties can be improved and the cost reduced by alloying, the pure metals have limited application. The one important exception is gold foil (platinum foil is also used, but to a much smaller extent). There have been variations in the popularity of this material, and it is still recommended by some dentists for use in properly selected cases.

In contrast with plastic filling materials such as cement or amalgam, a high degree of manipulative skill is required. Small bits of rolled foil are placed in the cavity and welded by the pressure of the instrument to the gold previously placed, the union taking place at ordinary temperature. This welding of the foil at room (or tooth) temperature under pressure alone is inhibited if certain gases are absorbed on the foil. In this condition it is called noncohesive, and if this gas is

Table 2.—Properties of gold, platinum and palladium

Property	Gold	Platinum	Palladium
Density at 20 C.	19.32	21.45	12.0
Structure	Face-centered cubic, $a_0=4.0704$ at 25 C.	Face-centered cubic, $a_0=3.9158\pm0.0003$ at 20 C.	Face-centered cubic, $a_0=3.8825\pm0.0003$ at 20 C.
Atomic diameter	2.878	2.769	2.745
Melting point	1945.4 F. 1063 C.	3224 F. 1773.5±1 C.	2830 F. 1554.4±1 C.
Thermal conductivity, cal./sec./cm.²/°C./cm.	0.7072	0.166 at 18 C.	0.168 at 18 C.
Thermal linear expansion $\times10^{-6}$	14.2 to 14.4 per °C. at room temperature	9.0 per °C. at 0 to 100 C.	11.8 per °C. at 20 C.
Specific heat	0.0308 at room temperature	0.0324 at 20 C.	0.0584 at 0 C.
Hardness	Annealed: 16.5 to 25 Brinell Cold rolled: 60 Brinell	Annealed: 37 to 50 Brinell 75% cold-reduction: 108 Vickers	Annealed: 37 to 49 Vickers 50% cold-reduction: 106 Vickers
Tensile strength, pounds per square inch	Annealed: 18,000 60% cold-reduction: 32,000	Annealed: 20,000 to 23,000 Cold-worked: 35,000	Annealed: 27,500 50% cold reduction: 47,000
Proportional limit, pounds per square inch	8,000	Annealed: 2,000	Annealed: 5,000 50% cold reduction: 30,000
Elongation, per cent	45 60% cold-reduction: 4	Annealed: 30 to 40 50% cold-reduction: 2.5 to 3.5	Annealed: 40 50% cold-reduction: 1.5
Modulus of elasticity	$(10.3-11.5)\times10^6$	$(21.3-24)\times10^6$	16.0×10^6

removed by heating (which may result in "corrugated foil") it can be made cohesive.[32] Some gases (such as those containing sulfur) cannot be so removed.

In a properly condensed gold foil filling, each piece of foil is entirely welded to the surrounding gold, forming a solid mass with a density not much less than that of cast gold. In addition, the pressure applied cold-works the gold so that it is several times harder than in the annealed condition. Properly made, such a filling can be at least as permanent as any other kind. On the other hand, an exacting technic is required, and the time required is greater than for an amalgam filling. Because considerable force is needed, no enamel can be left supported, and a healthy structure is required to withstand it.[33]

To explain the mechanism by which these alloys are hardened, it will be necessary to describe their atomic structure. Metals as a group have a characteristic structure in which the atoms are grouped together in a generally close-packed array, as depicted in Figure 3. These atoms have been stripped of their valence electrons, and these valence electrons form a sort of cloud which surrounds the atoms. Such an arrangement is electrically neutral.

A solid solution of two metals is very similar. However, a solid solution of two metals which have the same type of structure will form only if the relative size of the atoms is similar. It had been found that if the diameter of the atoms of one metal is 15 per cent more than that of another metal, there will not be extensive solid solubility. If the relative sizes of the two kinds of atoms fall within that limit, a region of solubility is probable, provided that there is not a strong tendency for the formation of an intermetallic compound.

In some cases, the conditions for solubility are so favorable that either element is soluble in any proportions in the other. This situation describes the gold-copper, gold-silver, copper-nickel and many other systems. Such systems are not heat-treatable. More commonly, solubility is limited. In the silver-copper system below 500 C., less than 1 per cent of silver will dissolve in copper, and less than 1 per cent of copper will dissolve in silver.[34] This degree of solubility changes with temperature. In the silver-copper system again, at 700 C., silver will dissolve 5.5 per cent copper, and copper will dissolve 4.5 per cent silver. These foreign atoms migrate in the solvent lattice by a process of diffusion.

32. Harder, O. E., *Modern Dental Metallography*. Minneapolis: Burgess-Roseberry Co., 1930, p. 121.

33. Thoen, E., Gold Foil, Its Selection, Character, Manipulation and Insertion. *J.A.D.A.* 29:422 (March) 1942.

34. Hansen, M., *Aufbau der Zweistofflegierungen*. Ann Arbor, Mich.: Edwards Bros., 1943.

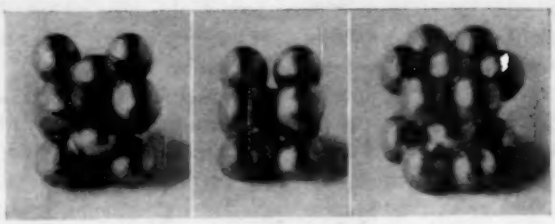

Fig. 3.—Three common types of crystal structure with the spheres representing atoms. Left: face-centered cubic. Center: body-centered cubic. Right: hexagonal close-packed. (Reproduced by permission from General Metallography *by Dowdell, Jerabek, Forsythe and Greene, published by John Wiley & Sons, Inc., New York)*

If cooling from an elevated temperature is rapid, there may not be sufficient time for the foreign atoms to diffuse out as they would under conditions of equilibrium. If this occurs, a supersaturated solution results, which is exactly the same as a supersaturated solution of ordinary chemical salts. The properties of metal in such a condition are little different than in the equilibrium state. However, if this supersaturated metal is heated slightly, equilibrium can be restored by precipitation of the excess phase. This precipitate will come out in very small particles throughout the grain, and so disrupt the normal structure that a very effective hardening action results.

This process is known as age hardening, or more accurately, as precipitation hardening. It should be noticed that age hardening depends on a *limited* degree of solid solution, and on a solid solubility which is greater at high than at low temperatures. In addition, the structure and size of the precipitating particles determine the effectiveness (the degree of hardening) which will result. Practically all commercial gold alloys age harden, because they all contain platinum, nickel and zinc in small quantities at least, or other such metals which dissolve in gold to a limited extent.

One other mechanism which can alter the properties of an alloy is known as order hardening, or the formation of a superlattice. The solid solution described above is random; the foreign atoms take up any position in the solute lattice. Under certain conditions, the two kinds of atoms will try to segregate in an orderly fashion. In an alloy which contains 50 atomic per cent of gold and 50 atomic per cent of copper (Fig. 4), very slow cooling will permit the atoms to diffuse until they are arranged in alternate layers of gold and copper atoms. Such a lattice is called ordered. Under normal conditions, this ordering will begin simultaneously at many points in the body of metal. Because the gold and copper atoms are not identical in size, the lattice is distorted from cubic to slightly tetragonal in shape. Moreover, this tetragonality can be in any one of three directions. Since the points of ordering are random, these ordered nuclei do not mesh when they grow out and meet each other. The result of all this is a considerable distortion of the lattice, and thus hardening. If conditions favorable for ordering are permitted to prevail, these separate regions of ordering will coalesce, until the ideal state of a single direction of ordering throughout the metal has been attained. In this condition the metal will no longer be very hard, but the properties will more resemble the random solid solution alloy. To effect ordering, an alloy is either cooled very slowly from an elevated temperature, or quenched and then reheated to a moderate temperature.

What are the requirements for an ordering alloy? First, there must be extensive solid solution so that the two atoms are present in ratios of small whole numbers. Of course, this requires that the atoms be similar in size. Ordering results because there is a lowering of energy from the random to the ordered solution. If the atoms are *very* similar in size, there will not be sufficient activating energy to cause the atoms to diffuse and form an ordered lattice. Hence, the second requirement is that the size of the two atoms cannot be too nearly the same. Thus gold and silver form a continuous series of solid solutions, but no superlattice. Gold has an atomic diameter of 2.878 angstrom unit and silver 2.883 angstrom unit. Copper, with an atomic diameter of 2.551 angstrom unit, forms a continuous solid solution, and in addition a superlattice, with gold. Cobalt forms only a limited solid solution with gold; its atomic diameter is 2.507 angstrom unit. Both order hardening and precipitation hardening can occur simultaneously, although generally the optimum conditions for one are not the same as for the other. In commercial gold

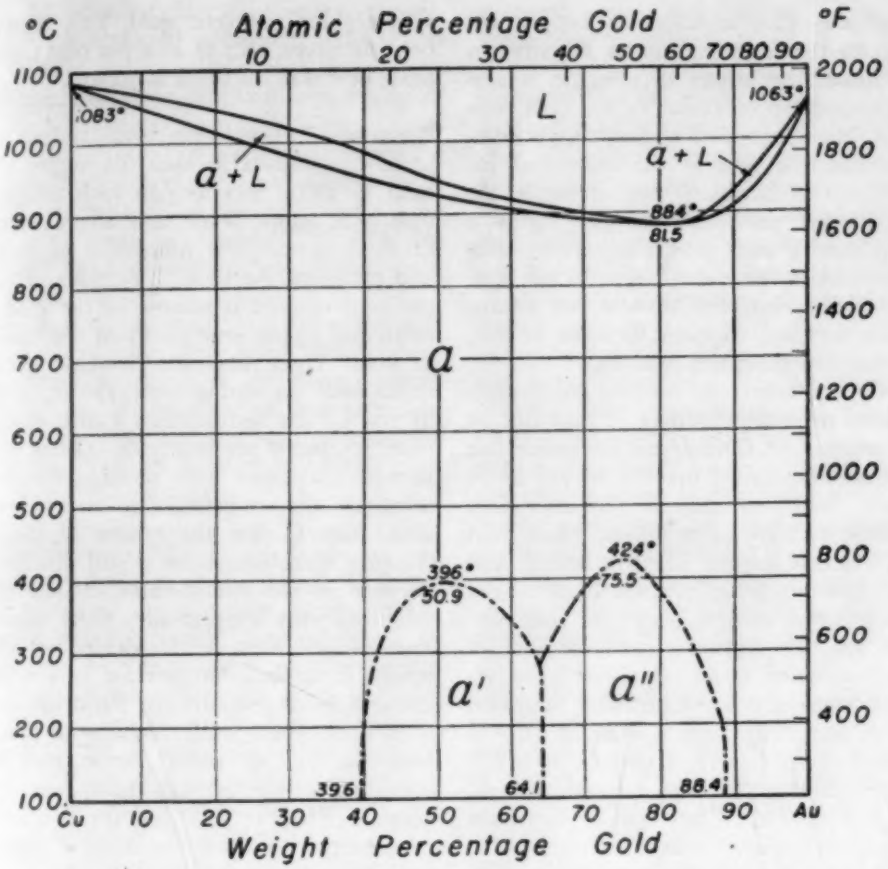

Fig. 4.—Gold-copper equilibrium diagram. (Reproduced from an article by D. Harker in 1948 Metals Handbook)

alloys, order hardening is the more effective, and alloys are designated to utilize this mechanism.

Commercial alloys are alloyed with copper, because this is the most effective and economical addition. With this as a basis, other elements are added to alter the properties in the desired direction.

Gold.—The tarnish-resistance of an alloy is almost a linear function of the gold (together with platinum and palladium) content. In general, the number of gold atoms must at least equal the number of base metal atoms. Therefore, the gold content must be at least 75 per cent by weight.[35] Swaging gold alloys usually have a high carat value because softness and malleability are needed. The minimum gold content of soft inlay alloys suggested by the Bureau of Standards is 83 per cent, and the minimum content suggested for hard inlays and cast crowns in 78 per cent.[36]

35. Smith, J. C., *The Chemistry and Metallurgy of Dental Materials*. Oxford.

36. Shell, J. J., *Hodgen-Shell—Dental Materials, 1938*. St. Louis: The C. V. Mosby Company.

Copper.—The addition of copper increases the hardness almost linearly. In addition, the ability to elongate is also increased, up to about 15 per cent copper. The purpose of adding copper is to decrease the cost of the alloy and increase the hardness and strength. As mentioned previously, copper forms a superlattice with gold, making the alloy amenable to heat treatment. In the copper-gold system, the liquidus and solidus lines are close together. Because of this, coring or segregation is slight.

Copper lowers the melting point when added to gold; this may or may not be an advantage. Casting is made easier, but the melting range may be so low as to make soldering difficult or impossible except with low-carat solders. More than 25 per cent copper is never added, and the quantity is usually less than 20 per cent. Alloys with 25 to 30 per cent copper are very brittle, possibly because of inclusions of CuO. However, the effectiveness of heat treatment is increased with increasing copper content (up to about 25 per cent copper by weight). More than 4 per cent must be present, and alloys with 8 per cent or more are readily responsive to heat treatment. The color of gold-copper binary alloys ranges from brown (17 per cent copper) to red (25 per cent copper).[35]

Silver.—The main purpose of silver in gold alloys is to counteract the red and grey colors produced by adding copper and platinum.[35] The strongest ternary alloy contains 8.3 per cent silver and 16.7 per cent copper.[35] Like copper, silver lowers the melting point of gold, but within the range of silver used in dental gold alloys, the silver will have very slight effect on the melting point. Also like copper, the melting range of gold-silver alloys high in gold is small. Gold-silver binary alloys containing from 25 to 40 per cent silver are green; above this amount the color tends toward white. Ternary alloys with copper may be yellow (58.3 per cent gold, 12.5 to 25 per cent silver, 16.7 to 29.3 per cent copper), or red if less silver is present.[32]

Platinum.—The gold-platinum system is somewhat unusual in that the degree of solid solubility increases to such an extent with temperature that above 1200 C. there is complete miscibility of gold and platinum. At 1000 C. only about 10 per cent of gold is soluble in the platinum, and 35 per cent platinum is soluble in gold. These amounts decrease even more with decreasing temperature, and at 700 C. the immiscibility gap extends from 3.5 to 75 per cent gold. Other intermediate phases with ordered atomic arrangements are believed to exist below about 600 C. but the nature of these complex transformations is still obscure. Because of the considerable change of solubility with temperature, these alloys are susceptible to age hardening which results in appreciable increase in tensile strength and proportional limit. However, because the solid solubility of platinum in gold at room temperature is about 15 per cent, significant changes in properties occur only in those alloys containing 40 per cent or more of platinum.[31]

In dental alloys, platinum is added for these four reasons:

1. Melting point is raised rather sharply with the addition of platinum. This is important with swaging alloys which will be fabricated by soldering.
2. Increasing platinum at the expense of silver or copper increases the noble metal content and improves the tarnish resistance.
3. The color of the alloy can be altered (and without losing other desirable properties).
4. Platinum tends to restrain grain growth on heating.[37]

37. Vines, R. F., and Wise, E. M., Age Hardening Precious Metal Alloys. In A.S.M. Symposium, 1939, pp. 190-230. See discussion by E. W. Skinner, p. 228.

In addition, the mechanical properties are changed somewhat. This is due at least partly to the marked grain-refining influence of platinum or any of the other platinum metals. The addition of 10 per cent platinum increases the proportional limit and ultimate strength 35 per cent. Gold-platinum alloys have a wide range of solidification, with the result that coring occurs in the castings.[33]

Because platinum and its alloys will withstand the high firing temperature without distorting or discoloring porcelain, they are used for making porcelain jacket crowns and as structural bases for certain types of fixed or removable porcelain bridgework.[31]

Palladium.—There is an increasing use of palladium in dental alloys. It is the cheapest of the platinum metals, and is even more effective than platinum in raising the temperature of the melting range. Other advantages are a low specific gravity (about two-thirds that of gold), and a whitening effect on gold alloys even with the addition of only 5 to 6 per cent. Alloys containing 15 per cent palladium are almost white.

The gold-palladium system consists of a continuous series of solid solutions, free from transformations in the solid state. The solidus lies close to the liquidus throughout. In general, palladium improves the strength, toughness and response to heat treatment of gold alloys. The resistance to tarnish is substantially increased compared with equivalent additions of copper or silver. Dental wrought gold alloys may contain up to 10 per cent palladium. Another group of alloys contains from 30 to 50 per cent of gold by weight and an equal or greater proportion of palladium.[37] Tests have shown that on a weight per cent basis, the partial replacement of gold by palladium considerably increases the resistance to tarnish, presumably by increasing the atomic percentage of total precious metal and thereby increasing the inherent nobility.[31]

Nickel.—Like the gold-platinum system, the gold-nickel system shows complete solid solubility at temperatures near the solidus and limited solubility at lower temperatures. However, the solidification range shows a minimum at 950 C. and approximately 17.5 per cent nickel. There is some evidence for a transformation at about 550 C. at the composition of AuNi, but this or other reactions have not been established beyond doubt.[34] Nickel is used in small amounts, usually up to 3 per cent. It tends to whiten and harden the alloy.[35] Larger quantities are not used because it tends to oxidize in casting and lower the tarnish resistance of the alloy. Also, if nickel is used in considerable amounts, the alloy is apt not to be amenable to the standard method of heat treatment.[37]

Zinc.—The addition of zinc sharply lowers the melting point of gold. Its most important function is to flux the oxides of metals such as copper and nickel. Hence it is added to casting alloys in quantities which seldom exceed 2 per cent. Because of the lowering of the melting point, the molten metal is more fluid, making possible more intricate castings.[34, 35]

Commercial alloys fall into two broad classes: those supplied in a wrought form and those intended for recasting. Alloys in either class supplied by any one manufacturer differ from each other in color (gold or platinum color) and mechanical properties such as strength, hardness and ductility. An increase in strength is always accompanied by increased hardness, and when these qualities are very high, the ductility is low. For many purposes 2 per cent elongation in the hardened condition is adequate, but for others, such as inlays in protected locations, elongation on the order of 25 per cent is desired to permit adequate

Copper.—The addition of copper increases the hardness almost linearly. In addition, the ability to elongate is also increased, up to about 15 per cent copper. The purpose of adding copper is to decrease the cost of the alloy and increase the hardness and strength. As mentioned previously, copper forms a superlattice with gold, making the alloy amenable to heat treatment. In the copper-gold system, the liquidus and solidus lines are close together. Because of this, coring or segregation is slight.

Copper lowers the melting point when added to gold; this may or may not be an advantage. Casting is made easier, but the melting range may be so low as to make soldering difficult or impossible except with low-carat solders. More than 25 per cent copper is never added, and the quantity is usually less than 20 per cent. Alloys with 25 to 30 per cent copper are very brittle, possibly because of inclusions of CuO. However, the effectiveness of heat treatment is increased with increasing copper content (up to about 25 per cent copper by weight). More than 4 per cent must be present, and alloys with 8 per cent or more are readily responsive to heat treatment. The color of gold-copper binary alloys ranges from brown (17 per cent copper) to red (25 per cent copper).[35]

Silver.—The main purpose of silver in gold alloys is to counteract the red and grey colors produced by adding copper and platinum.[35] The strongest ternary alloy contains 8.3 per cent silver and 16.7 per cent copper.[35] Like copper, silver lowers the melting point of gold, but within the range of silver used in dental gold alloys, the silver will have very slight effect on the melting point. Also like copper, the melting range of gold-silver alloys high in gold is small. Gold-silver binary alloys containing from 25 to 40 per cent silver are green; above this amount the color tends toward white. Ternary alloys with copper may be yellow (58.3 per cent gold, 12.5 to 25 per cent silver, 16.7 to 29.3 per cent copper), or red if less silver is present.[32]

Platinum.—The gold-platinum system is somewhat unusual in that the degree of solid solubility increases to such an extent with temperature that above 1200 C. there is complete miscibility of gold and platinum. At 1000 C. only about 10 per cent of gold is soluble in the platinum, and 35 per cent platinum is soluble in gold. These amounts decrease even more with decreasing temperature, and at 700 C. the immiscibility gap extends from 3.5 to 75 per cent gold. Other intermediate phases with ordered atomic arrangements are believed to exist below about 600 C. but the nature of these complex transformations is still obscure. Because of the considerable change of solubility with temperature, these alloys are susceptible to age hardening which results in appreciable increase in tensile strength and proportional limit. However, because the solid solubility of platinum in gold at room temperature is about 15 per cent, significant changes in properties occur only in those alloys containing 40 per cent or more of platinum.[31]

In dental alloys, platinum is added for these four reasons:

1. Melting point is raised rather sharply with the addition of platinum. This is important with swaging alloys which will be fabricated by soldering.
2. Increasing platinum at the expense of silver or copper increases the noble metal content and improves the tarnish resistance.
3. The color of the alloy can be altered (and without losing other desirable properties).
4. Platinum tends to restrain grain growth on heating.[37]

37. Vines, R. F., and Wise, E. M., Age Hardening Precious Metal Alloys. In A.S.M. Symposium, 1939, pp. 190-230. See discussion by E. W. Skinner, p. 228.

In addition, the mechanical properties are changed somewhat. This is due at least partly to the marked grain-refining influence of platinum or any of the other platinum metals. The addition of 10 per cent platinum increases the proportional limit and ultimate strength 35 per cent. Gold-platinum alloys have a wide range of solidification, with the result that coring occurs in the castings.[35]

Because platinum and its alloys will withstand the high firing temperature without distorting or discoloring porcelain, they are used for making porcelain jacket crowns and as structural bases for certain types of fixed or removable porcelain bridgework.[31]

Palladium.—There is an increasing use of palladium in dental alloys. It is the cheapest of the platinum metals, and is even more effective than platinum in raising the temperature of the melting range. Other advantages are a low specific gravity (about two-thirds that of gold), and a whitening effect on gold alloys even with the addition of only 5 to 6 per cent. Alloys containing 15 per cent palladium are almost white.

The gold-palladium system consists of a continuous series of solid solutions, free from transformations in the solid state. The solidus lies close to the liquidus throughout. In general, palladium improves the strength, toughness and response to heat treatment of gold alloys. The resistance to tarnish is substantially increased compared with equivalent additions of copper or silver. Dental wrought gold alloys may contain up to 10 per cent palladium. Another group of alloys contains from 30 to 50 per cent of gold by weight and an equal or greater proportion of palladium.[37] Tests have shown that on a weight per cent basis, the partial replacement of gold by palladium considerably increases the resistance to tarnish, presumably by increasing the atomic percentage of total precious metal and thereby increasing the inherent nobility.[31]

Nickel.—Like the gold-platinum system, the gold-nickel system shows complete solid solubility at temperatures near the solidus and limited solubility at lower temperatures. However, the solidification range shows a minimum at 950 C. and approximately 17.5 per cent nickel. There is some evidence for a transformation at about 550 C. at the composition of AuNi, but this or other reactions have not been established beyond doubt.[34] Nickel is used in small amounts, usually up to 3 per cent. It tends to whiten and harden the alloy.[35] Larger quantities are not used because it tends to oxidize in casting and lower the tarnish resistance of the alloy. Also, if nickel is used in considerable amounts, the alloy is apt not to be amenable to the standard method of heat treatment.[37]

Zinc.—The addition of zinc sharply lowers the melting point of gold. Its most important function is to flux the oxides of metals such as copper and nickel. Hence it is added to casting alloys in quantities which seldom exceed 2 per cent. Because of the lowering of the melting point, the molten metal is more fluid, making possible more intricate castings.[34, 35]

Commercial alloys fall into two broad classes: those supplied in a wrought form and those intended for recasting. Alloys in either class supplied by any one manufacturer differ from each other in color (gold or platinum color) and mechanical properties such as strength, hardness and ductility. An increase in strength is always accompanied by increased hardness, and when these qualities are very high, the ductility is low. For many purposes 2 per cent elongation in the hardened condition is adequate, but for others, such as inlays in protected locations, elongation on the order of 25 per cent is desired to permit adequate

Table 3.—Properties of gold-palladium alloys

Composition, per cent				Melting range, degrees F.	Brinell hardness number	Elongation, per cent	Density
Gold	Palladium	Platinum	Silver				
63	30	7	—	2687 to 2649	53.0	34.0	16.4
58	39	3	—	2737 to 2700	53.5	35.3	15.6
47	50	3	—	2784 to 2746	60.5	36.0	14.7
39	58	3	—	2871 to 2831	60.0	35.0	14.1
32	65	3	—	2860 to 2826	58.0	35.0	13.7
—	90	—	10	2739	54.0	34.0	11.7
—	80	—	20	2662	64.0	40.0	11.6
—	70	—	30	2525	62.5	43.0	11.5
—	60	—	40	2507	56.0	44.0	11.4

burnishing. While the ultimate strength is usually specified, the magnitude of the proportional limit or elastic limit is of much greater importance. These values measure the maximum stress which may be imposed before distortion of the part occurs, and any additional stress on the distorted metal before fracture is of lesser significance.

The basis of most of the alloys may be considered to be a ternary of about 70 per cent gold and approximately equal parts of copper and silver for the remainder. The copper-silver ratio is altered according to the strength required, and additional elements, such as platinum, nickel and zinc are added to effect changes in melting point, cost, color and so forth. To all but the softest inlay golds, 2 to 6 per cent platinum or palladium, or both, is usually added.

As gold alloys intended for clasps require increased strength and particularly a high elastic limit, without sacrificing ductility altogether, the simple gold-silver-copper alloys are not satisfactory. Consequently it is necessary for this purpose to employ alloys containing a higher percentage of the platinum metals. As much as 15 per cent of platinum is sometimes employed, but with such a high content there may be a danger of cracking under ordinary manipulation.[35] Besides a high elastic limit, the addition of platinum imparts added resistance to fatigue failure. In an effort to replace the more expensive gold, some Russian scientists have attempted to substitute palladium for it. Their results are reported in Table 3.[38]

Composition and properties of some typical commercial alloys are given in Table 4.[39]

Cobalt-Chromium Base Alloys

Until recently dental castings have been based almost exclusively on gold or platinum alloys. A rapidly increasing proportion of dentures are now being produced from alloys based on cobalt and chromium.[40] It has been estimated that in this country today five times as many cast dentures are made of these alloys as of gold. The fundamental requirements for a successful substitution are these:[36]

1. The technical difficulties should not be so great that the average dentist cannot use the alloy.

2. The chemical properties must be such that the material does not produce

38. Nemilov, V. A., and Rudnitski, A. A., Russian Substitute Palladium in Dental Alloys. (Abstract) *Iron Age* 154:98 (Sept. 14) 1944.

39. *A. S. M. Metals Handbook*, 1939 edition. Cleveland: American Society for Metals.

40. Smith, Ernest A., Vitallium as a Substitute for Dental Gold Casting Alloys. *Brit. D. J.* 85:180 (Oct. 15) 1948.

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Table 4.—Composition and properties of dental golds

Type	Composition, per cent by weight						State	Yield point, pounds per square inch	Tensile strength, pounds per square inch	Elongation, per cent	Brinell hardness number
	Gold	Silver	Copper	Zinc	Palladium	Platinum					
Yellow wrought wire	70.8	15.5	13.2	0.5	—	—	Annealed, 700 C., and quenched	40,500	65,000	32.0	—
							Annealed and oven cooled†	63,500	93,000	9.6	—
Yellow wrought wire*	63.8	15.5	13.2	0.5	—	7.0	Annealed, 700 C., and quenched	62,000	95,000	14.1	—
							Annealed and oven cooled†	70,000	145,000	0.8	—
White wrought wire*	49.0	17.8	15.5	0.5	17.6	—	Annealed and aged, 400 C.	98,000	135,000	2.5	—
							Annealed, 700 C., and quenched	45,000	84,000	29.3	—
							Annealed and oven cooled†	88,000	146,000	7.4	—
							Annealed and aged, 400 C.	94,000	137,000	8.0	—
White wrought wire	60.0	9.0	12.0	2.0	12.0	5.0	Annealed, 700 C., and quenched	61,000	99,000	22.0	150
							Annealed and oven cooled†	116,000	150,000	10.0	248
White wrought wire	55.0	8.0	12.5	1.0	7.5	17.0	Annealed, 700 C., and quenched	102,000	128,000	12.0	200
							Annealed and oven cooled†	153,000	180,000	5.0	280
Inlay casting gold	90.0	1.5	7.0	0.5	—	1.0	Cast	16,500	46,000	25.0	80
Denture casting alloy	70.0	11.0	11.0	1.0	3.0	4.0	Cast and annealed	41,000	72,000	10.0	142
							Cast, annealed and oven cooled	75,000	105,000	2.5	230
Denture casting alloy	15.0	45.0	15.0	1.0	24.0	—	Cast and annealed	50,000	81,000	5.0	175
							Cast, annealed and oven cooled	83,000	109,000	1.0	242

Data from *1939 Metals Handbook.*
*Aged at 400 C. for 15 minutes.
†Cooled from 450 to 250 C. in 30 minutes.

pathologic effects in the patient or operator and does not disintegrate in the fluids of the mouth.

3. Physical properties such as strength, melting point, coefficient of expansion and heat conductivity must be satisfactory.

4. The material should be plentiful and inexpensive and should be available even in periods of emergency.

That these requirements are met is shown by the present acceptance of cobalt-chromium alloys. The advantages of these alloys over precious metal alloys are:

1. Gingivae and soft tissues of the mouth show a greater tolerance to them than to gold alloys.

2. As a second consequence of their high degree of insolubility in oral fluids, they retain their brightness and high polish.

3. Weight of the denture is considerably less. This is due to both the lower specific gravity (8.9 vs. 16.9) and the greater strength, which permits thinner sections.

4. The cost is lower.

5. The greater hardness means that the high degree of polish obtainable will tend to be retained under abrasive conditions.

6. Greater rigidity of cobalt-chrome alloys makes them preferable for dentures which depend on support from as many teeth as possible.[41]

The inherent disadvantages of these materials are:

1. More and costlier equipment is required to make the castings. The production of dentures from cobalt-chrome alloy tends to be concentrated in the larger laboratories.

2. Ductility may be less than that of some gold alloys. However, properly made alloys will have adequate ductility.

3. Cobalt-chrome alloys cannot be heat treated in the same manner as gold alloys. They are precipitation hardenable but not order hardenable, and they cannot be softened to the same degree to permit adjustment, and later rehardened.

4. The lower modulus of elasticity of gold alloys is an advantage for certain types of partial dentures where some freedom of movement is desired without undue clasp pressure on a tooth.

5. Higher metal casting temperature and greater shrinkage in solidifying requires the use of special investment technics.

6. Polishing is more difficult than is the case with gold alloys.

Objection has been raised to the use of these alloys on the assumption that a dangerously great electrolytic action would be present.* Measurements have shown it to be no worse than gold in this respect, and possibly better.[42-44] In each case, the couple formed with silver amalgam showed the greatest flow of current.

The first of these alloys to be produced in this country was "Vitallium," in 1929. Dentures of this material have been worn since 1931, and in 1932 the alloy was patented.[45] The composition and properties of four commercial alloys are shown in Table 5.[30, 46]

Alloys of the type shown in Table 5 are essentially not forgeable, and are used only in the cast condition.

It is the chromium which to a large degree imparts the corrosion resistance. Carbon is only slightly soluble in the solid solution of cobalt and chromium, and is present as small finely dispersed

41. Crawford, W. H., and Phillips, R. W., Physical Properties of Wrought Alloys Used in Dentistry. *J.A.D.A.* 29:359 (March) 1942.

42. Campbell, W. C., Internal Fixation of Fractures —Analysis of the Reaction of Various Metals. *J. Indiana State M. A.* 38:12 (Dec.) 1939.

43. Venable, C. S., and Stuck, W. G., Electrolysis Controlling Factor in the Use of Metals in Treating Fractures. *J.A.M.A.* 136:111 (Oct. 8) 1938.

44. Bernier, J. L., and Canby, C. P., Histologic Studies on the Reaction of Alveolar Bone to Vitallium Inplants. *J.A.D.A.* 30:188 (Feb.) 1943.

45. Siddle, G. H., *The Technique of Stainless Steel Work in Mechanical Dentistry*, ed. 2. London: Kimpton, 1945.

46. Paffenbarger, G. C.; Caul, H. S., and Dickson, G., Base Metal Alloys for Oral Restorations. *J.A.D.A.* 30:852 (June) 1943.

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Table 5.—Composition of cast cobalt-chromium alloys

Alloy	Chromium	Cobalt	Nickel	Molybdenum	Tungsten	Carbon	Beryllium	Other
Durallium*	31.4	62.1	0.11	5.8	—	0.15	—	0.62 iron, 0.68 manganese, 0.16 silicon, trace aluminum
Niranium*	30	46	11	6	8	0.2		
Ticonium†	27.4	28.7	37.5	4.6	—	0.2	1.2	0.2 silicon, 0.2 aluminum
Vitallium†	30.8	62.5	—	5.1	—	0.4	—	0.7 iron, 0.5 manganese, 0.3 silicon

*Data supplied by manufacturer.
†Data from Paffenbarger, Caul and Dixon (ref. 40).

globules of chromium carbide. The strength, ductility and corrosion resistance are all affected by the presence of this carbide phase. The presence of carbide-forming elements such as tungsten (tantalum would be excellent) tends to stabilize the alloy and makes for more uniform properties from one casting to the next. Beryllium has the effect of lowering the melting temperature of the alloy.[47]

All of the alloys contain a small amount of nitrogen, from 0.06 to 0.10 per cent. Nitrogen has effects similar to those of carbon. It was determined that alloys which contain more chromium also contain more nitrogen. Manganese imparts a large degree of stability in the alloy, making the behavior of the alloy more definite and predictable. The addition of 1 per cent manganese to "Vitallium" imparts greater strength and ductility, and vastly improves the ductility of the alloy 6059 with a smaller increase in strength. Above 1 per cent, manganese progressively causes poorer cast surfaces when used with a silica-base investment material. In some alloys cobalt is replaced in part by nickel, at a saving in cost. Measurements made at the Massachusetts Institute of Technology showed that the alloy 6059, which resembles "Ticonium," wherein about half of the cobalt is replaced by nickel, was somewhat weaker than "Vitallium," but much more ductile.[48] The composition of these alloys is given in Table 6.

In Table 7, the figures preceding the letters in the alloy designation (for example, 29 in alloy 29V-O) are the values of the carbon content in hundredths of a per cent.

47. Touceda, E. G., Claim Concerning Denture Alloy Containing 65-90% Ni, 5-30% Cr, and 0.1-5% Be. U. S. Patent No. 2,089,587, August 10, 1937.

48. Grant, N. J., The Stress Rupture and Creep Properties of Heat-Resistant Gas-Turbine Alloys. *Trans. Metals* 39:981, 1947.

Table 6.—Composition of some experimental cobalt-chromium alloys

Designation	Carbon	Chromium	Cobalt	Nickel	Molybdenum	Manganese	Other
V-0	0.24 to 0.35	23	68	—	6	1	—
V-4	Variable	23	67	—	6	4	—
VT2-2	Variable	23	67	—	6	—	2% tantalum added, nitrogen present
R-6	0.41 to 0.49	26	32	32	6	1	—

It is important that comparisons be made on materials of equivalent grain size. It has been found at M. I. T. that the grain size is a function of both metal- and mold-casting temperatures.[49, 50] With increasing temperature of metal or mold, or both, the grain size increases, and as a result the metal is weaker and more ductile. Variation in the temperature has the additional effect of changing the carbide spacing. The carbide spacing increases with increasing mold temperatures, but remains constant with increasing metal temperatures. In this case the ductility is affected more than the strength; the ductility increases with an increase in carbide spacing. These results are due to the effect of the added heat from the metal or mold on the nucleating and grain growth tendencies of the metal. If comparisons are made of alloys of similar carbon content, cast under commensurate conditions and given equivalent heat treatment, it can be seen that the R-6 type alloy is invariably more ductile and somewhat weaker than the corresponding V or VT alloy.

The importance of the grain size on mechanical properties has been generally overlooked. A comparison of the alloys in Table 7 shows this influence clearly. Two 29V-O alloys received identical heat treatment and differed only in their grain size. The ductility of the fine-grained was less than half that of the same alloy cast so as to give a larger grain. The same results are borne out in the comparisons of alloys 35V-O and 37VT2-3 (aged at 1350 F.), of 48R-6 and 49R-6 (both as cast), and 48R-6 and 49R-6 (both aged). In all cases, the ductility decreases markedly with a decrease in grain size. Changes in strength are less pronounced and usually less im-

49. Grant, N. J., Structural Variations in Gas Turbine Alloys Revealed by the Stress Rupture Test. *Trans. Am. Soc. Metals* 39:333, 1947.

50. Grant, N. J., The Effect of Composition and Structural Changes on the Rupture Properties of Certain Heat Resistant Alloys at 1500° F. *Trans. Am. Soc. Metals* 39:368, 1947.

Table 7.—Properties of cast cobalt-chromium base alloys

Alloy	Heat treatment	Metal temp., degrees F.	Mold temp., degrees F.	Tensile strength, lb. per sq. inch	Elongation, %	Reduction of area, %
29V-0	48 hours at 1350 F.	2680	1850	121,300	5.1	6.6
29V-0	48 hours at 1350 F.	2680	1500	113,100	2.6	2.5
35V-0	48 hours at 1350 F.	2770	2000	127,500	10.4	4.0
31V-0	48 hours at 1350 F.	2680	1850	136,300	3.3	6.0
37VT2-3	As cast	2695	1850	102,800	5.9	10.7
37VT2-3	48 hours at 1350 F.	2695	1850	115,500	2.6	7.0
99VT2-2	As cast	2825	1850	113,100	3.6	0.9
102VT2-2	As cast	2605	1850	120,000	3.2	0.8
41R-6	As cast	2735	1850	76,000	10.2	20.0
48R-6	As cast	2695	1500	89,600	6.5	6.4
48R-6	48 hours at 1350 F.	2695	1500	91,400	4.4	5.5
49R-6	As cast	2680	1850	85,200	9.2	10.4
49R-6	48 hours at 1350 F.	2680	1850	103,800	4.1	5.6

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Table 8.—Composition of some castable, corrosion resistant, low carbon alloys

Alloy	Chromium	Nickel	Cobalt	Molybdenum	Tungsten	Iron	Others
Inconel	13 to 15	75 to 80	—	—	—	balance	Titanium, aluminum
Invar	—	36	—	—	—	balance	—
Monel	—	67	—	—	—	1.4	30 copper, manganese
Nichrome	15 to 20	60 to 80	—	—	—	balance	—
Hasteloy	0 to 10	60 to 80	—	0 to 27	0 to 8	balance	—
K42B	20	42	23	—	—	7	2 to 3 titanium
Konel	—	73	17	—	—	10	Titanium

portant; failures are more commonly due to insufficient ductility.

There is a limit to the improvement in ductility obtainable by increasing the grain size. If it is increased to a point where there are only a few grains, or perhaps a single grain, to the cross-section, the properties are strongly dependent on the chance orientation of those grains. Under such conditions it is possible for the strength or the ductility to be either very high or very low. The optimum set of conditions, then, is that which results in a small number, such as 4 to 6, of grains in the critical cross-sections (such as the clasps). To produce a casting with a predetermined grain size requires measurement of the temperature of the metal before casting or a set of casting conditions, such as flame size and heating time, which could be reproduced (and the use of mold ovens without thermal gradients). The result would be the production of castings not only of improved quality, but more important, of uniform, predictable properties.

Generally speaking, aging at 1350 to 1500 F. cuts down the room temperature ductility as much as 50 per cent but increases the strength slightly. The lowest temperature at which the aging precipitate will form is 1350 F. Above 1600 F. the precipitate is taken back into solution, so aging at temperatures above that level would have a smaller effect. The importance of considering the effects of aging lies in the possibility of altering the properties of the alloy when a denture is soldered or welded. Most gold solders fuse in the range of 1400 F. to 1650 F. Solders of lower melting point are available, but generally they do not possess adequate resistance to corrosion.

Other general types of castable, corrosion resistant alloys are available (designed for use at high temperatures in most cases) which apparently have not been fully investigated as possible denture materials. Some of these are listed in Table 8.

In conclusion, it should be emphasized that since the cost of the metal is such a small part of the cost of the total dental restoration, cost alone does not justify the substitution of a base metal where a noble one might give more satisfactory service. However, when a base metal alloy has been shown to be superior, there should be no hesitancy in using it merely because it does not happen to contain gold.

Stainless Steel

This class of alloys is known in the orthodontic field as "chrome alloys," or "chrome-nickel alloys." The one material which is widely used has a composition of 18 per cent chromium, 8 per cent nickel and small amounts of columbium or titanium, the remainder being iron. The carbon content of such a steel is low,

less than 0.15 per cent. When made under commercial conditions so that nitrogen is not excluded, the atoms of the alloy take up a face-centered cubic arrangement; it is said to be in an austenitic condition. The atoms of the ferrite in ordinary steel are arranged in a body-centered cubic configuration. Because of this fundamental difference in structure, the austenitic alloy is much more corrosion resistant, while retaining many of the desirable qualities of ordinary steel.

The advantages of this material in dentistry are these:

1. It has exceptionally high tensile strength. This may be as high as 326,000 pounds per square inch, with 140,000 pounds per square inch as an average. These figures apply to cold-drawn wire, the material most commonly used in orthodontic appliances.

2. It has great elasticity. Ductility is also high. For a comparable strength, stainless steel has greater ductility than gold alloys.

3. Its corrosion resistance is at least as good as that of gold alloys.

4. There is greater freedom from adherence of plaques and food debris with 18-8 steel than with gold alloys.[51]

5. Construction time of an orthodontic appliance is half, or less, that required if gold alloys are used.[51]

6. Lower density, coupled with the higher strength, means much lighter appliances.

In this country, stainless steels in dentistry are used almost exclusively for orthodontic appliances. In some countries, especially England, they are used for wrought denture bases.[45] The general indifference to stainless steels for that purpose in this country will probably continue as long as gold is available at a reasonable price. Very slight use is made of castings of this material.[52]

Orthodontic Appliances.—It has been estimated that the requirements for orthodontic appliances in this country for a year are 3,000 pounds.[53] Cold drawn wire and cold rolled sheet are the basic

51. Yost, Howard, Practicability of Chrome Nickel Alloys for Orthodontic Use. *J. A. D. A.* 23:798 (May) 1936.

52. Chavy, Raymond, The Casting of Very Small Pieces in Stainless Alloys for Dental Settings. (Abstracted from *Bull. Asso. Tech. Fonderie* 17:49, 1943.) *Inst. Met., Met. Abst.* XII, 1945, p. 397.

53. Chrome Alloy and Orthodontics. (Editorial) *Am. J. Orthodont. & Oral Surg.* 28:594 (Sept.) 1942.

Table 9.—Representative properties of stainless steel used for orthodontic appliances

Material	Tensile strength, pounds per square inch	Yield strength, pounds per square inch	Elongation, per cent	Reduction of area, per cent
0.008 inch hard-drawn wire	326,000	270,000	1 (max.)	—
0.018 inch hard-drawn wire	309,000	240,000	1 (max.)	—
Completely annealed	85,000 to 95,000	30,000 to 35,000	55 to 60	70 to 75

Specific gravity	7.8
Melting point, approx.	2580 to 2700 F.
Partial softening	1700 to 1800 F.
Complete softening	2000 to 2100 F.
Specific heat	0.118 calories per degree C.
Thermal conductivity	0.0390 cgs units at 100 C.
Modulus of elasticity	29,000,000

media for the construction of appliances. Some representative properties are shown in Table 9.[54, 38]

The use of such an obviously desirable material as stainless steel depended on the devising of an adequate technic. Solders were first employed, often with incomplete success. Spot welding was then used.[55] It is especially applicable because of the usual uniformity of dimensions. This method of fabrication has been completely successful. Because no additional material is added, electrolysis does not occur at the junction. Furthermore, and of considerable importance in some cases, the cold-worked structure is not destroyed, and the high strength of the steel is retained. If desired, attachments of gold alloy may be made by spot welding, although this may not be wise because of the possibility of corrosion. Successful welding depends on the use of a stabilized steel; one in which the carbon content is very low, or one to which columbium or titanium has been added to combine with the residual carbon. The formation of chromium carbides during welding would deplete the surrounding region of chromium, making it much more susceptible to corrosion.

Later it was shown that strong and dependable soldered joints could be made, using a flux such as potassium fluoride.[54, 56] The present opinion is that either spot welding or soldering may be used, depending on the individual requirements.[51, 57]

Wrought (Swaged) Denture Bases.—Stainless steel is used for denture bases with complete success where the technic for its manipulation has been mastered.[48] More dies are required, but because of the time saved by spot welding the total time is no greater. In some cases where the permissible thickness of metal is limited, as with a "close bite," the use of steel permits a stronger denture base. In all cases the weight is less. Another advantage is that a steel partial denture can have new extension teeth added by soldering without stripping off all teeth and resin, as would be required before soldering a gold denture. Scalding of tissue due to hot food or drink is less likely because of the higher specific heat and lower thermal conductivity (about 1/9 that of gold alloys).

One disadvantage of stainless steel compared with the order- and precipitation-hardenable gold base alloys is the inability to soften the steel for fabrication and adjustment, then later reharden it by heat treatment. Ordinarily, prostheses are annealed as required during fabrication, but are left in the work hardened state on completion. This is satisfactory if later repair work is done by spot welding, but soldering would leave the piece weakened. Recently an age-hardenable 18-8 stainless steel has been introduced, which may help spread the use of this material.[58]

Minor Metals for Restoration or Dentures

While dental work with metallic materials is confined very largely to those mentioned previously, many attempts have been made to utilize the more common base metals. Naturally one incentive was the lowering of cost for the material, but much of the effort was occasioned by the unavailability of the precious metals. A third inducement for work along this line was the hope of improving the standard alloys by the addition of new metals.

Aluminum.—Attempts have been made to use pure aluminum and aluminum alloys

54. Carman, J. L., Metallurgy and Use of Chrome Alloys in Orthodontics. *Am. J. Orthodont. & Oral Surg.* 24:346 (April) 1938.

55. Walsh, L. T., Five Years With Chrome Alloy. *Am. J. Orthodont. & Oral Surg.* 24:445 (May) 1938.

56. Sorrels, T. W., Soldering Chrome Alloys. *Tr. Am. Soc. Orthodont.*, 1936, p. 218. *Int. J. Orthodont. & Oral Surg.* 23:45, 1937.

57. Bell, Brooks, and Siersma, G. H., Chrome Alloy Techniques. *Am. J. Orthodont. & Oral Surg.* 27:705 (Dec.) 1941.

58. DuMond, T. C., New Age-Hardening Stainless Steel Provides Strength Without Cold Working. *Stainless W. Materials & Methods* 23:432 (Feb.) 1946.

as denture bases and inlays. The pure metal is too soft (the tensile strength ranges from 13,000 pounds per square inch for annealed aluminum to 24,000 pounds per square inch for the hard metal) for use except in protected locations. In spite of the fact that a tenacious oxide forms, corrosion in the mouth is fairly rapid. Considerably improved performance is possible if the surface is first anodized; more than six years of satisfactory service have been reported for anodized dentures.[59] Difficulties have been reported in soldering, and there may be galvanic action when aluminum is brought into contact with other metals. Alloys of aluminum have been used, principally in Germany and Russia. Results of one alloy (an aluminum-silicon-magnesium-titanium alloy) were reported in these words: "The stability in tests lasting 2-3 months in the presence of other metals in the mouth was satisfactory, only 2 fillings out of 60 showing signs of corrosion."[60] Such behavior does not compare very well with that of conventional materials.

Copper.—Copper base alloys (used especially in central Europe) have not proved satisfactory. When used as denture bases, irritation of soft tissue has occurred.[46] In general, this possibility of irritation or poisoning is the principal deterrent to their more widespread use. In addition, copper alloys (especially aluminum bronze) are difficult to solder and difficult to cast, and they do not have high strength.

Recently an alloy containing 52.5 per cent copper, 46 per cent zinc and 1.5 per cent aluminum was investigated as a substitute for dental inlay casting gold. Such a composition would have low strength (approximately 60,000 pounds per square inch) and poor corrosion resistance.[61]

Tin.—Tin base alloys have likewise not been accepted. Among the compositions tried was an alloy called "Acolite," containing 72.5 per cent tin and 27.5 per cent antimony and one used in Germany consisting of tin, antimony and gallium. The former was brittle and tended to discolor, and the latter suffered from the additional disadvantage of being poisonous.[46]

Indium.—This metal, recently available at a moderate price, shows possibilities for dental use. It is white, soft and ductile, and slightly heavier than zinc. Most important, it is highly resistant to oxidation. It has been claimed to produce surface stability when incorporated in an amalgam, and has been used in the gold alloys of two manufacturers in place of zinc. In spite of its possibilities indium appears to be oversold; actual benefits from its use have not been shown. In the future, it will possibly be used for small additions to other alloys. A silver-indium alloy which will not discolor in sulfides would require 40 per cent or more of indium, and such an alloy is impractically hard and brittle.[62-65]

Conclusion

The present state of the art of dental metallurgy, for it is still more of an art than a science, has been discussed. What advances may be expected? It is likely that the conventional gold and amalgam alloys will be steadily, though slowly, im-

59. Tregarthen, G. G. T., Anodic Treatment of Aluminum and Its Alloys for Use in the Mouth. *Brit. D. J.* 76:300 (June 2) 1944.

60. Kauffmann, Edmund, Dental Fillings Made From Aluminum and Their Stability in the Mouth. *Deut. zahnarztl. Wochschr.* 45:409, 1942. *Chem. Zentr.* 1:2110, 1943.

61. Worner, H. K., A Base Metal Alloy Substitute for Dental Inlay Casting Golds. *Austral. J. Den.* 45: 293 (Dec.) 1941.

62. Indium in Dentistry. *J. Am. Col. Den.* 9:448 (Dec.) 1942.

63. Dement, Jack, and Dake, H. C., *Rarer Metals.* Brooklyn: Chemical Publishing Company, 1946.

64. Hopkins, B. S., *The Chemistry of Less Familiar Elements.* Champaign, Ill.: Stipes, 1938, p. 17.

65. Williams, R. V., Use of Indium in Dental Alloys. *J. Am. Col. Den.* 5:78 (March) 1938.

proved. With the alloys now at hand, it would be entirely possible to produce dentures of considerably improved properties. Since practically all fabrication is done by small laboratories, no attention is paid to some important variables, such as grain size, and casting and heat-treating temperatures. Of course the equipment for such control is not ordinarily at hand. However, if stronger, more ductile dentures, and especially dentures of more consistent and reproducible properties, were demanded by dentists, they could be produced with the knowledge now at hand and without a prohibitive increase in price.

With a few notable exceptions, the suppliers of dental materials seem to have been reluctant to explore at all adequately entirely new combinations of metallic elements. Tantalum, for instance, has shown its worth in surgery, and one wonders if it could not be used in dentistry. Titanium, only recently available in quantity, is strong and as corrosion-resistant as the stainless steels. Except for the small use of copper, all present amalgams are based on silver. Gold and the platinum metals are soluble in mercury, and it is entirely possible that such a filling material, although more costly, might have superior properties. For the production of cast dentures, a heat treatable alloy is desirable. Since the solution temperature preparatory to age hardening of many alloys (such as the cobalt-chromium alloys) is impractically high, search should be made for combinations of elements which would yield new order hardenable alloys. Such an investigation need no longer be empiric; the science of metallurgy has developed to the point that predictions can be made from published data of the metals, and unlikely combinations could be quickly eliminated from consideration.

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Physiology and Temperament.—In 1884 Jonathan Hutchinson started a series of lectures with the following sentences: "Our forefathers, who knew far less about the detail of pathology than we do, attached far more importance to such matters as temperament and diathesis. They were accustomed to prescribe for a man's temperament; we think only of his disease, and turn aside with weariness from classifications of diathesis in which the physicians of an older day delighted. Although to a large extent this change of sentiment has been the result of advance in knowledge, yet I think it might easily be shown that it has gone too far, and that we now neglect unwisely the study of those differences between man and man of which, for the most part, physiology takes no cognizance, but which may yet prove of much importance in modifying the processes of disease." *I. B. Sneddon, "The Mind and the Skin," Brit. M. J., March 19, 1949, p. 472.*

THE NATIONWIDE TOPICAL FLUORIDE DEMONSTRATION PROGRAM

John W. Knutson, D.D.S., Dr. P.H., Washington, D.C.

A REPORT of major interest to the dental profession was submitted on April 27, 1948, by the Committee on Appropriations, House of Representatives, Eightieth Congress. The report provided for the appropriation of $1,000,000 to enable the Public Health Service to set up a nationwide program for demonstrating the efficacy of topically applied sodium fluoride as a preventive against tooth decay. The demonstration program, the report stated, would be conducted in close cooperation with state health departments, dental societies and other organizations. It would bring this relatively new procedure to the attention of dentists and the American people.

Provision for a dental demonstration program was of special significance because of several factors. Among these was the official cognizance of Congress that an effective method for partially controlling dental caries was available. Furthermore, this was the first instance in which Congress made provision for financial support of a specific dental program on a nationwide basis.

The action of Congress was based on the results of some eight years of research with thousands of children. Findings from the first clinical tests on topical fluorides were reported in 1942 and 1943.[1-2] During the next seven years, several investigators reported that topically applied sodium fluoride had reduced the incidence of dental caries by about 40 per cent. It is highly significant that confirmation of the caries prophylactic value of this procedure rested on the results of numerous investigators, that the number of children in the study groups was adequate and that so-called blind controls were used; that is, the dental examiner did not know which teeth were treated and which were untreated.

In May 1947 the Council on Dental Therapeutics[4] stated that "the evidence is convincing that fluoride solutions properly applied to the teeth are capable of a limited inhibiting effect on tooth decay in children considered collectively." In September 1947, more than 100 dentists, scientists and public health workers met at Ann Arbor, Michigan, to evaluate dental caries control measures. This group concluded that the topical fluoride procedure had been subjected to adequate clinical testing. The research data, these investigators agreed, warranted the conclusion that the method was effective in reducing the dental caries incidence in children by approximately 40 per cent.

The State and Territorial Health Officers Association reviewed the same evidence in the fall of 1947. It, too, concluded that topical fluorides had been

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Dental director, chief, Division of Dental Public Health, Bureau of State Services, U. S. Public Health Service, Washington 25, D. C.

1. Bibby, B. G., New Approach to Caries Prophylaxis. *Tufts D. Outlook* 13:4 (May) 1942.

2. Cheyne, V. D., Human Dental Caries and Topically Applied Fluorine: A Preliminary Report. *J.A.D.A.* 29:804 (May) 1942.

3. Knutson, J. W., and Armstrong, W. D., The Effect of Topically Applied Sodium Fluoride on Dental Caries Experience. *Pub. Health Rep.* 58:1701 (Nov. 19) 1943.

4. Council on Dental Therapeutics, American Dental Association. Report on Topical Application of Fluorides. *J.A.D.A.* 34:700 (May 15) 1947.

demonstrated to be effective and that this partial caries preventive should be made available to all children. In October 1947, the Dental Section of the American Public Health Association unanimously endorsed the proposal that community programs for making this preventive available to children be organized as soon as possible.[5] In January 1948, the Council on Dental Health of the American Dental Association published a recommendation that topical fluoride treatment be used routinely in private offices and in school and community health programs.[6]

Thus it may be seen that the action of Congress was not precipitous. It was taken after data and information on topical fluorides had been subjected to thorough examination, and after an evaluation by outstanding authorities in the field of dental health.

The Grants-in-Aid Proposal

When the Surgeon General in his opening statement before the House Appropriations Committee reviewed the problems in public health and the progress made in their solution during the year just passed, he referred to some of the new activities worthy of special attention. Members of the Committee were very much interested in what he had to say about the dental program. The nature of their questions showed an awareness of dental health problems and, more specifically, a keen interest in the preventive potentialities of topical fluorides. However, they disapproved the proposal that $1,500,000 be made available to the states in the form of grants-in-aid for specific promotion of topical use of fluorides.[7]

The Committee expressed the view that a grants-in-aid program was not essential to reaping the full benefits of this preventive method. It thought the same results could be accomplished by a program of public information conducted with the cooperation of the dental profession and state and local health departments. Accordingly, the Committee urged the Public Health Service to bring this new development to the attention of as many people as possible so that the fullest benefit could be obtained. At subsequent Committee hearings and after consultation with the Executive Committee of the State and Territorial Health Officers Association regarding a program to implement the expressed wishes of Congress, the proposal was made that $1,500,000 be appropriated for grants to the states. This proposal included a request that additional funds be provided for equipping and staffing demonstration and training units for assignment to the states, and also funds for promotional functions. The Committee had the benefit of testimony from representatives of the American Dental Association, the National Congress of Parents and Teachers, the State and Territorial Health Officers Association and the National Grange.

View of Appropriations Committee

The Committee, however, again rejected the grants-in-aid proposal. The following appears in its report:

> The Committee has determined that field demonstration units should be established to operate in the States under a close cooperative arrangement with State health departments, dental societies, and other organizations. It would be the purpose of these units, roughly one mobile unit for each State; to demonstrate to dentists, dental hygienists, State and local health department personnel, et cetera, the correct technic of making sodium fluoride application to the teeth; to serve as a training mechanism for Public Health personnel; and generally to publicize and promote interest in

5. Resolution Adopted by the Dental Health Section, American Public Health Association. Minutes of 75th Annual Meeting, Atlantic City, New Jersey, Oct. 7, 1947.

6. Council on Dental Health, *A.D.A. Newsletter*, vol. 1, no. 1, p. 1, Jan. 23, 1948.

7. The Supplemental Federal Security Agency Appropriation Bill, Fiscal Year 1949. House of Representatives, Report No. 1821, 80th Congress, 2nd Session.

the procedure. In recommending the appropriation of $1,000,000 additional to implement this program of demonstration, it should be clearly understood that the Committee does not view this program on the part of the Public Health Service as a permanent fixture. Rather it is the view of the Committee that if the demonstration facilities are properly managed they will thoroughly cover the several States and make the procedure so widely known and available, that the Public Health Service can and should withdraw from active participation of the type herein provided for.

Operation of the Program

Soon after the decision of the Appropriations Committee of Congress had been made, a meeting of state dental directors was held in Washington, June 23 to 25, 1948, to consider methods and procedures for operating the fluoride demonstration program. At this meeting consideration was given to staffing the mobile units with a dentist, two dental hygienists and a clerk. The mobile unit would be assigned to a state only on formal request from the state health authority. It is of interest that virtually all such requests have been endorsed by representatives of the state dental society or the dental advisory committee of the state health department.

The topical fluoride demonstration units are in fact operating on the same basic principle as grants-in-aid. Each unit is under the immediate supervision of the dental director of the state health department, who is responsible for selecting the areas in which the team will work. Areas are selected on the basis of their accessibility to dentists, dental hygienists, public health workers and others interested in the development of health programs. The units operate in schools, and each is assigned to a community for not longer than six weeks. In making such assignments, the interests of local dental societies are an important consideration. Depending on the size of the community, treatment may be given to all the school children or only to children in selected grades or in certain age groups. All these determinations are made after consultation with the local health officials, dental society representatives and school authorities.

In conducting the demonstrations, the dentist in charge inspects each child's teeth, the dentist and hygienists make the applications and the clerk fills in a record card for each child. Parents are notified if their children need dental care, and the records are made available to local authorities to use as they see fit. Thus, each demonstration consists of three principal steps: dental inspection, fluoride applications and referral.

Instead of grants of funds, the program operates essentially as a grant of personnel, equipment and material. The units operate under specific regulations which are uniform for the country. At the present time, teams are operating in thirty-five states and territories, including Alaska, Hawaii, Puerto Rico and the District of Columbia. Assignment of units to additional states will be made as soon as personnel and equipment are available.

Reception

If our interpretation of public reaction to this program is correct, its popularity, in most instances, outranks that of other current community health programs. The units are very well received. Local newspaper support has been excellent, and the cooperation of local groups, such as dentists, school and health officials and the parent-teacher associations usually has been enthusiastic. Articles featuring the benefits of topical fluorides have appeared in many popular periodicals. In a few instances these articles show signs of a bit of conflict between editorial license and scientific fact. It must be admitted, however, that the writers have done much to present the true story of this caries preventive. They have also, of course, stimulated a broad

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interest in dental health—an interest which some dentists may have observed in their offices. This, it seems to me, is all to the good, for both the profession and the public.

The Technic

Some few dentists have resented the fact that the topical fluoride technic has been called simple, and others have suggested that its simplicity eliminates the need for demonstrations of the technic. The technic is simple, but precise. The application becomes simple only when made in an orderly fashion and after experience with the steps in the procedure, and particularly the step which is so simply stated, "Isolate the teeth with cotton rolls." To isolate effectively, the rolls must be placed and retained so that they do not touch the teeth and absorb the solution, a task that can be most trying and difficult.

I earnestly recommmend that dentists visit one of the demonstration units to observe the technic and the procedure. The many dentists who insist that an application requires from half an hour to forty-five minutes can examine there a procedure which is exacting, accurate and definite, and which can be carried out in the office in not more than fifteen minutes.

The Community Takes Over

Aside from any technical information that may be obtained through observation of the unit, I should like to urge every dentist to visit the demonstration for a more important reason; that is, to become familiar with this dental health activity in his community. Such first-hand information can help him and his society in discussing plans for bringing topical fluoride to the children in his community.

This brings us to the most important point, the real purpose of the fluoride demonstration program. Congress has clearly indicated that the demonstration units should serve as a device to bring this preventive measure to all children—that the units should publicize the procedure and demonstrate how community fluoride programs might operate. Congress does not see this as a permanent program. I can assure you that the U. S. Public Health Service views it as a temporary program, a true demonstration program, a program designed primarily to stimulate the establishment of permanent community programs.

Community interests must be aroused before local fluoride programs can be established. The teams are potent aides in stimulating such interests. However, interest alone will not establish a program. That interest must be properly directed so that it will result in appropriate community organization and action. Here, local dental societies should meet their professional responsibility for proper guidance of effort directed toward improving the dental health of the community. How the service is made available to each child—what this service will mean in terms of community dental health—how the program affects the public relations of the dental profession—all these things are important.

In other words, the dentist has a stake in how such community programs are conducted. Yes, the dentist has a stake, but he must not forget that the public also has a stake, and that it is highly compatible with his. It should be relatively easy to work out a fluoride program acceptable to all. This does not mean that such a program will be uniform for every community. In some communities the services may be provided by local dentists. In others they may be provided largely by dental hygienists assigned to the school health services. In still others, the program may be a combination of both. I am confident that in all instances parents will expect their family dentist to be conversant with the method of application, the usefulness

and the limitation of topical fluorides.

Locally organized and operated programs can be kept close to the needs of the people they serve. Local dentists can guide them, largely determine their quality and make them flexible enough to meet changing needs and situations. The locally established fluoride program inevitably brings together dentists, health officials, community leaders, school superintendents and representatives of civic organizations. As these groups work with dentists in focusing the attention of the community on dental health problems, the public will come to realize that the profession is making important contributions to the health of the community. Our profession can gain much in terms of increased prestige and greater public understanding through active participation in the development of local programs.

Such locally organized fluoride programs are in line with the national trend toward the development of community health programs. The American Medical Association is demonstrating considerable interest in this field. The dental profession can, and should, see that dentistry is well represented in all such programs to improve general health. Now, for the first time, dentistry has a specific preventive measure that can be applied on a mass, community-wide basis. The measure has been proved effective, and parents want their children to have it. I believe it is up to us to help and guide them in their efforts to get it.

The American Dental Association, in its statement of principles which should govern dental health program planning, has this to say[8]:

> Dental health is the responsibility of the individual, the family and the community, in that order. When this responsibility, however, is not assumed by the community, it should be assumed by the State and then by the Federal Government. The community in all cases shall determine its methods for providing service.

Again, in its statement on goals for dental health programs, the American Dental Association lists six steps for an immediate plan of action. The second step is[8]:

> The control of dental diseases by the expansion of community dental programs, integrated in the general health program, to make dental care and dental health education available to every child.

Those excerpts are from the program of the American Dental Association for promoting dental health in this country. They are based on the policies adopted by its House of Delegates, and are the result of more than ten years' study by several committees and councils of the Association.

Other Demonstration Programs

The worth of demonstration programs has been demonstrated. Typhoid fever, venereal disease and tuberculosis control programs were launched as demonstration or combination demonstration and grants-in-aid programs. Typhoid fever control was initiated in 1914-1915 with a series of field studies and demonstrations. The nature of this work brought the Public Health Service into close, mutually helpful relationships with state and local health authorities and laid the basis for the present system of federal-state cooperation. The other two programs, venereal disease and tuberculosis, have since become largely grants-in-aid programs. The three programs have contributed a great deal to the health of our people.

Significance

The fluoride demonstration program is helping to improve the dental health of the country through:

1. Providing information on the ap-

8. The Program of the American Dental Association. *J.A.D.A.* 38:512 (April, Section 2) 1949.

proved application technic to dentists, health officials, civic leaders and the public.

2. Showing how community fluoride programs might operate.

3. Stimulating national and local interest in dental health.

4. Marshalling local resources—dentists, civic organizations and health officials—in community-wide attacks on the problem of dental caries.

The profession of dentistry has certain innate responsibilities. Those responsibilities extend far beyond the doors of each individual office. They extend into the home and the community and throughout the nation—wherever people are in need of better health. During recent years, there have been ever-increasing signs that the family dentist is striving to meet those responsibilities. More and more he has become interested in dental health on a community-wide basis. Now that he has a partial caries preventive, I believe that he will bring it to as many children as possible. But I don't believe the family dentist will stop there. He will recognize that a partial caries preventive is not enough.

Interest in the topical application of sodium fluoride is an excellent starting point for developing more effective appreciation and utilization of the whole gamut of modern dental health services. This larger undertaking can be launched by coupling dental inspections with the topical fluoride program and by establishing an effective system of referral for necessary treatment services.

The launching and maintenance of such programs will broaden the horizons of opportunity for both the dental profession and the public. In charting the course for the launchings the importance of integrating the dental with the general health program of a community will become clearer. The number of community dental health programs launched will determine whether or not dentistry joins the voyage now under way to establish adequate local health services, community by community, throughout the nation.

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Orthodontics and Public Health.—The question of orthodontics is no longer something that concerns those who have a lot of money. Orthodontics is too important in the life and welfare of children for such a limited view to prevail. The benefits of orthodontics are now appreciated by families of children of every economic level.

The "Principles for Public Dental Programs for Children," published by the Children's Bureau of the Federal Security Agency under the Social Security Administration, defines orthodontics as a public health function in the following terms:

"The correction of dentofacial deformities when efficiency of the dental mechanism is threatened by a present or potential condition which will cause tissue injury or interfere seriously with function or with mental or physical development."—*J. A. Salzmann, "Orthodontics as a Public Health Activity," New York D. J. 15:140, March 1949.*

PERIAPICAL PULP CANAL THERAPY

Norman Rosen, D.M.D., New York

THE principle upon which a root canal method of therapy is prescribed should be similar to all other surgical concepts, namely, that dentists do not heal an infection, but only assist nature to do so.

Root canal, or pulp canal therapy, or endodontia, generally is practiced as the treatment of infected pulp tissue within a tooth. These names literally designate this form of treatment. However, this method is not effective when bacteria remain lodged in dead bone or necrotic tissue in the periapical region beyond the limits of the canal of a tooth. It is here where body circulation, through its inflammatory exudate, actually is the healing factor and the best that can be done is to assist nature's inflammatory response. This can be done either by reducing the count of the invading organisms or by preventing their further growth.

Root canal therapists should, therefore, not only eliminate pulp canal infection, but help nature to eliminate periapical infection as well. Since nature tends to combat infection by means of an inflammatory exudate, it is this exudate that should be understood. Included here is a brief description of the elements of such an exudate and their functions.[1,2,3]

1. Phagocytes—appear in acute inflammatory process. (*a*) Polymorphonuclear leukocytes—derived from the blood: remove bacteria. (*b*) Large mononuclear cells—derived from tissue as wandering cells (histiocytes), or from monocytes of blood: phagocytic for cellular debris: may group as giant cells for this purpose.

2. Round cell infiltration—appears in chronic inflammatory process. (*a*) Small lymphocytes; (*b*) plasma cells; (*c*) eosinophils. These cells are derived from bone marrow, lymph tissue and blood: function questionable, but probably has to do with antibody and antitoxin formation. *(d)* Mast cells (basophils)—found in connective tissue around blood vessels: produce heparin, an anticoagulant to permit phagocytosis.

3. Lymph fluid—appears in both acute and chronic inflammatory processes—derived from the blood as plasma: neutralizes bacterial toxins; contains antibacterial substances as opsonins, agglutinins and antitoxins; contains fibrinogin for repair.

If the periapical infection is small, eliminating infection in the root canal may be sufficient to bring about healing through the inflammatory exudate. That is why, in root canal therapy on vital pulps, where periapical infection is at a minimum, success usually is attained.

If the periapical infection is complicated by the presence of necrotic tissue and bone and is too great for the individual defense mechanism in this region, eliminating the canal infection may not

1. Cahn, L. R., Study of Periapical Pathology: Its Influence on Pulp Canal Therapy. *New York J. Den.* 12:328 (Oct.) 1942.

2. Grossman, L. I., *Root Canal Therapy*, ed. 2. Philadelphia: Lea & Febiger, 1946, p. 44.

3. Menkin, Valy, *Dynamics of Inflammation*. New York: The Macmillan Company, 1940.

be sufficient. Such therapy may result in either (1) a further growth of periapical pathology resulting in rarefying osteitis or an acute alveolar abscess or (2) a walling off with a pyogenic membrane, resulting in a granuloma, radicular cyst or chronic alveolar abscess.

Figure 1 shows the comparative fight between local body resistance and the growth of an infective process at the apex of a tooth. The patient, a middle-aged woman, had improper periapical pulp canal therapy performed on three lower anterior teeth many years before the present roentgenogram was taken. Since the three teeth had been treated at the same time, it can be assumed that the same septic conditions existed for all. However, with the lower left lateral incisor, the periapical infection obviously was great enough to overcome the local body defense mechanism, and the infected area continued to grow. This condition appears reversed with the two central incisors, where the periapical infection seems to have been held in abeyance as exemplified by a lack of apical bone destruction (Fig. 1, *A*). Figure 1, *B* is a roentgenogram taken six months after the lower left lateral incisor had been properly re-treated. It shows nature's healing response when given good surgical assistance.

From the preceding facts, I feel that it is best to designate the term "periapical pulp canal therapy," or "periapical endodontia" as more fitting than the present terms of "root canal therapy" or "endodontia," which center attention on pulpal treatment alone.

A Method of Treatment

Periapical pulp canal therapy has to do with the elimination of infection within the periapical and pulpal portion of a tooth. This can be done, in most instances, by conservative treatment without resorting to apicoectomies or periapical curettage. If the infecting organ-

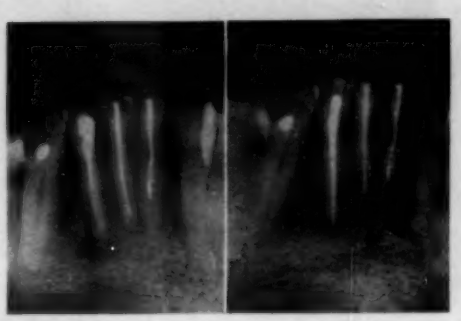

Fig. 1.—Left: Roentgenogram showing faulty treatment which was done ten years previously. Right: Six months after periapical pulp canal therapy had been repeated on the lateral incisor

isms in and about a tooth can be eliminated, nature, through its inflammatory response, will heal the damaged region. Today, it is considered poor medical practice for the ear physician to resort to a mastoid operation when this bone area can be cured conservatively through the newer drugs, such as penicillin and the sulfonamides.

The same drugs have been found applicable in periapical pulp canal therapy. Local concentration of penicillin and sulfanilamide solutions will, through surface contact, produce zones of bacterial inhibition of varied degrees. This has been demonstrated *in vitro* as well as *in vivo*.[4, 5, 6, 7] However, it is questionable that such a zone is great enough to extend from an antibiotic dressing confined in the canal of a tooth through a periapically infected area. The failures that some investigators[8, 9] claim in using this

4. Rosen, Norman, Root-Canal Therapy and the Use of Sulfonamides. *J.A.D.A.* 31:622 (May) 1944.

5. Rosen, Norman, Use of Sulfonamides in Root Canal Therapy. *New York J. Den.* 13:143 (Apr.) 1943.

6. Buchbinder, Maurice, Laboratory and Clinical Study of Penicillin in Root Canal Therapy. *J.A.D.A.* 34:108 (Jan.) 1947.

7. Potkin, N. N., The Use of Penicillin in Treatment of the Root Canal. *J.A.D.A.* 34:459 (Apr.) 1947.

8. Grossman, L. I., Evaluation of Antibiotic Agents for Root Canal Treatment. *New York J. Den.* 15:233 (June-July) 1945.

9. Grossman, L. I., Treatment of Pulpless Teeth With a Concentrated Sulfonamide Solution. *J.A.D.A.* 32: 1432 (Dec.) 1945.

method as the form of treatment can be attributed to this limitation.

If these antibiotics can be forced into the infected area beyond the root as an irrigant, then it is reasonable to expect the same sterilizing effect at this point as occurs in the canal of a tooth.[10, 11, 12] Such an irrigant is applied through the canal of a tooth with pressure, using a 2 cc. B-D syringe with a 23 gage Yale Luer abscess needle. Because of the innocuous character of sulfanilamide and penicillin, no tissue irritation will be produced. These are the first drugs that can be used freely in the apical region to combat infection there. Other drugs might disinfect but will hinder the inflammatory response by causing tissue damage. This is especially true of electrolytic medication which invariably produces a chemotrauma after its application.

Those who doubt whether sufficient quantity of the antibiotic solution can be forced through the apical opening, will realize, on second thought, that this is a relatively easy matter. Refer to the ease with which chloropercha, for instance, extrudes through the apex with relatively mild pressure. The apical foramen can be penetrated first with a no. 2 Kerr file.

For disinfecting the canal itself, the orthodox root canal medicaments, such as beechwood creosote or metacresyl acetate, may be used as a dressing in conjunction with these antibiotics. They produce a synergistic action against the invading organisms.[7]

The concentration of the antibiotics recommended for use in this work is an approximate 5,000 units of penicillin per cubic centimeter and 7 per cent warm sulfanilamide solution. An average of 4 or 5 cc. of either may be used at one sitting. Basically, the form of periapical pulp canal treatment consists of alternating at different visits penicillin with sulfanilamide solution as an irrigant while mechanically cleansing the canal, and sealing in, alternately, with the use of a cement, one of the orthodox medicaments as a dressing. The alternation of these drugs enhances the effectiveness of each as a disinfectant, since it eliminates the tolerance organisms can acquire against the repetitious use of the same drug. Approximately six visits, seeing a patient on an average of twice a week, will complete most cases.

Penicillin is obtainable in a crystalline sodium form, penicillin G, and comes in a glass container of 100,000 unit quantity or more. This crystalline penicillin, unlike the amorphous yellow salt, does not require refrigeration to maintain its efficiency. It is stable at room temperature and, therefore, can be kept in an office cabinet indefinitely.

It is recommended that a fresh quantity of penicillin solution be made for each patient. This is done by dissolving approximately one fifth of the 100,000 units in 4 cc. of sterile saline solution or distilled water to give the desired concentration of 5,000 units per cubic centimeter. A graduated dissolving cup serves as a convenient holder. Penicillin will go into solution readily. Quantitatively, it is not necessary to be too accurate to obtain the desired concentration, since locally penicillin is effective with a minimum of 250 units per cubic centimeter and, if more than 5,000 units per cubic centimeter were to be used, it still will be effective without producing any toxic reaction. The curve of its efficiency has been found not to increase beyond the recommended concentration.[6]

Penicillin has been found to be effective against all the organisms encountered in periapical pulp canal therapy. It is bactericidal as well as bacteriostatic.

Sulfanilamide is obtainable in a sterile crystalline form and, as such, it is dis-

10. Bender, I. B., Penicillin in Root Canal Therapy: Report of Fifty-three Cases. *J.A.D.A.* 34:99 (Jan.) 1947.

11. Adams, F. R., Pulp Canal Therapy: Eighteen Months' Experience With Penicillin. *J. D. Soc.* (N.Y.) 12:63 (Apr.) 1946.

12. Stewart, G. G., Preliminary Report on Penicillin in Root Therapy. *J.A.D.A.* 33:1981 (Oct.) 1946.

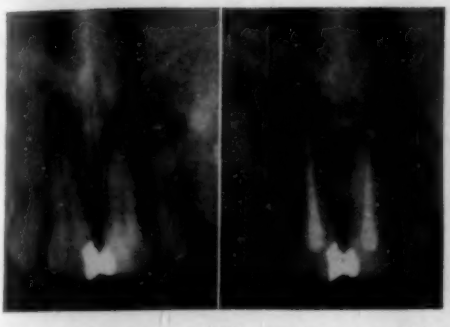

Fig. 2.—Case of a middle aged woman. Left: Chronic abscesses with fistulas. Right: Regions six months after treatment

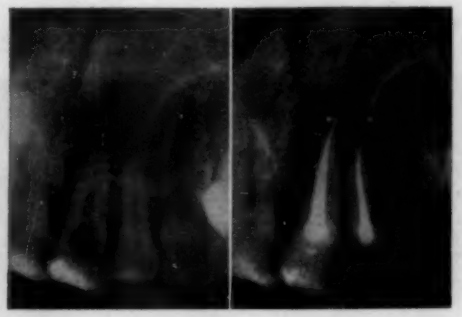

Fig. 3.—Case of a boy aged 15. Left: Subacute abscess with discharging fistula. Right: Note bone regeneration six months after treatment

Fig. 4.—Left: Chronic abscesses resulting from carious exposure on the upper right second bicuspid and improper therapy on the upper left first bicuspid. Right: Six months after treatment on both teeth

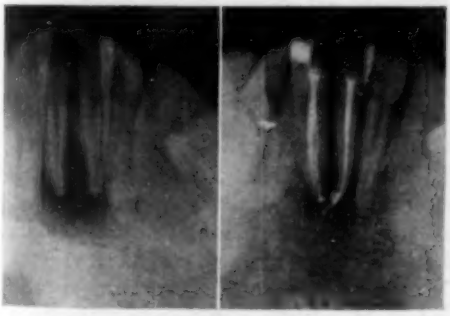

Fig. 5.—Case of a boy aged 14. Left: An acute abscess developed after he received a blow. Right: Affected region three months after periapical pulp canal therapy

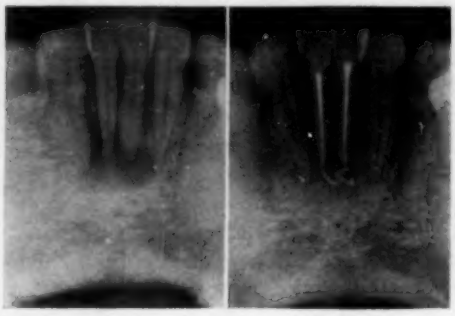

Fig. 6.—Case of a young woman. Left: Chronic abscesses before treatment. Right: Region six months after treatment. Note bone regeneration

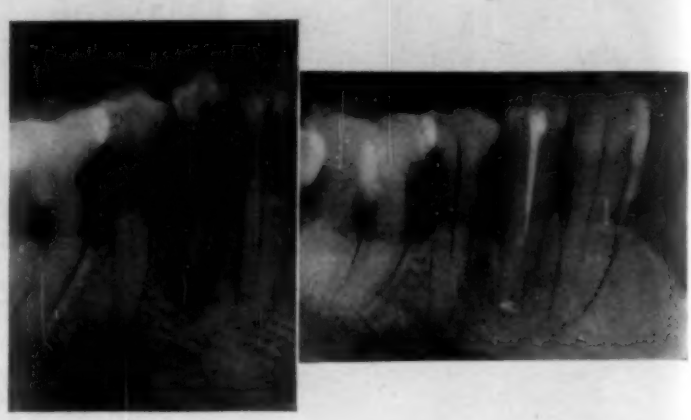

Fig. 7.—Case of a middle aged woman. Left: Chronic abscess complicated with pyorrhea. Right: Affected region approximately six months after periapical pulp canal therapy

solved in sterile saline solution or distilled water. A fresh solution, like penicillin, is made for each patient. Although it is soluble to the extent of 1.97 per cent in water at body temperature, solubility is increased to more than 7 per cent at 60 C. (140 F.)[5] at which temperature it is applied. The warm solution is forced into the periapical region, where 1.97 per cent of the sulfanilamide will remain soluble in the serum, while the remainder of the 7 per cent will crystallize out in this region. As the soluble portion of the sulfanilamide is absorbed, the remainder of the crystallized salt will dissolve into the local tissue fluid.

In dealing with a supersaturated solution, the amount of sulfanilamide crystals used is unimportant, since only a limited amount will go into solution. Enough of the salt is taken to cover the bottom of a Novol dissolving cup, 5 cc. of sterile saline solution or distilled water are added and the mixture heated.

Sulfanilamide, although effective against all organisms related to pulp pathology, is particularly effective against the streptococcal type of infection which generally predominates in the chronic type of infection. The sulfonamides are primarily bacteriostatic and are found to be more effective in the absence of pus and tissue debris. Therefore, drainage and débridement are necessary surgical adjuncts to this form of chemotherapy.

It has been shown that incompatibility exists between penicillin and those drugs that are oxidizing, such as hydrogen peroxide, or medicaments containing active chlorine as well as iodine compounds.[6, 13] Therefore, none of the latter should be used in conjunction with penicillin as a pulp canal dressing.

The accompanying roentgenograms are examples of results of the method of periapical pulp canal treatments just described. Figures 2 to 6 indicate the condition of teeth before treatment and the results of the healing processes as shown by these teeth in roentgenograms taken approximately six months later. Figure 6, left, shows the condition of the two lower central incisors of a young woman. She was referred by an oral surgeon for periapical pulp canal therapy before having apicoectomies done. For this reason the canals were overfilled. It was decided to forego the apicoectomies and watch for bone regeneration. Figure 6, right, shows the region six months after treatment. Figure 7 is an interesting case in that it shows that pulp infection can be cured even though it

13. Hoffman, W. S., Penicillin: Its Use and Possible Abuse. *J.A.D.A.* 34:89 (Jan.) 1947.

is complicated with pyorrhea. The case of a middle-aged man is shown in Figure 8. The patient was a hemophiliac, and extraction of the tooth might have been fatal.

This form of chemotherapy does not preclude the importance of a careful aseptic technic. The teeth must be isolated and the field kept from contamination through use of a rubber dam applied to the region being treated. Instruments, cotton material, trays and rubber dam should be sterilized properly by boiling and autoclaving. The canals of treated teeth must be filled to the apex, although, histologically, it has been shown that it is irrelevant if a canal is slightly overfilled or underfilled. Bacteriologic checks are important to determine when a canal is ready for filling. Smears or cultures may be resorted to for this purpose.

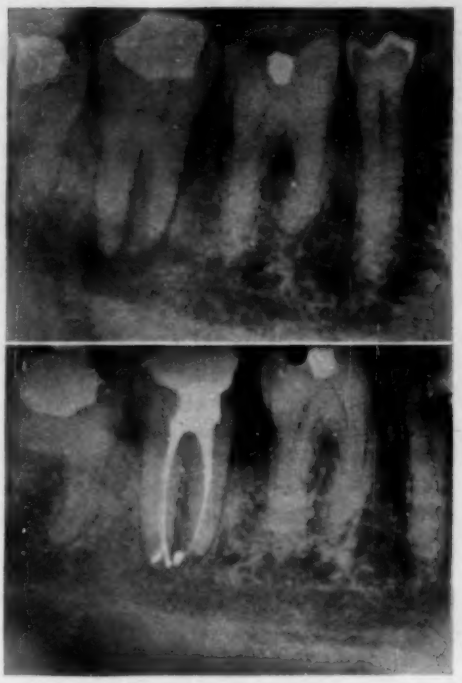

Fig. 8.—Above: Chronic abscess with fistula. Below: Approximately five months after completion of treatment

Conclusions

"Periapical pulp canal therapy" or "periapical endodontia" are more fitting and descriptive than the terms "root canal therapy" or "endodontia," since periapical tissue as well as pulpal tissue is being treated.

The principle upon which a periapical pulp canal method of therapy is prescribed is to assist nature, through its inflammatory exudate, to eliminate the infection.

From theoretic, experimental and clinical points of view, it is rational to conclude that in periapical pulp canal therapy sulfanilamide and penicillin aid in eliminating infection.

Chemotherapy with antibiotics is not a panacea in periapical pulp canal therapy, but must be supplemented by an aseptic technic.—*981 Madison Avenue.*

▲

The "Right" to Health.—The assumption that people have a "right" to health is as false as the notion that everyone is entitled to freedom from want. Nothing could be more viciously destructive of initiative, effort, and progress. Health is a privilege, not a right. And as a privilege it demands the acceptance of individual responsibility for conservation.—*Edward J. Stieglitz, A Future for Preventive Medicine. New York: The Commonwealth Fund, 1945, p. 44.*

FUNDAMENTAL REQUIREMENTS FOR TRAINING IN ORAL SURGERY

THE American Board of Oral Surgery was created to meet the demand for recognition of proficiency in the specialty of oral surgery.

The widespread interest expressed in the American Board of Oral Surgery, despite its comparatively recent inauguration and the small amount of publicity which it has received, has been astonishing. This interest is mainly evidenced by the large number of inquiries received by the secretary of the Board with reference to training requirements necessary to fulfill eligibility for examination leading to certification. From the beginning, the Board has emphasized the desirability of adequate training of those who apply for certification. The Council on Dental Education of the American Dental Association has asked the Board to act in an advisory capacity in determining the fundamental requirements for training in oral surgery and a committee[1] was appointed by the Board to undertake this study. An ideal of making available to the greatest possible number of people the benefits of the best oral surgical training and scientific knowledge is the aim of this committee in establishing fundamental requirements for training in oral surgery.

The primary purposes of drafting approved plans for training in oral surgery are: (1) to establish and encourage a degree of uniform instruction in this surgical specialty, (2) to promote a cooperative effort between hospitals and postgraduate institutions so as to assure experienced guidance in training programs, (3) to expand opportunities for training in oral surgery into a greater number of hospitals that have acceptable facilities and (4) to provide sufficient training services for those members of the medical and dental professions desiring training in this surgical specialty.

Types of Institutions Offering Acceptable Programs

University or Teaching Hospitals.—Programs of training in these institutions provide excellent instruction but such opportunities are available only to a limited number of dentists. These institutions not only should increase the number of trainees to the fullest extent, but they should make available their facilities for instruction in the basic sciences to applicants who might procure their clinical oral surgery training elsewhere. Where the training is carried to completion in these institutions, a degree is usually earned. Several university graduate schools, after a year of instruction in the basic sciences, together with instruction in other related subjects, consider the student oral surgeon a candidate for a master's degree, even though the clinical instruction is procured at some other approved hospital service. This arrangement is to be encouraged as it offers the greatest opportunity for increasing the number of training programs.

Prepared and adopted by the American Board of Oral Surgery. This suggested program of study and training for those planning to take the American Board of Oral Surgery has been approved for trial by the Council on Dental Education of the American Dental Association. A joint committee of the Council and the Board of Oral Surgery has been directed to give this program continued study and attention.

1. Members of the special committee: James R. Cameron, Philadelpha; J. Orton Goodsell, Saginaw, Mich.; Douglas B. Parker, New York, and Don H. Bellinger, chairman, Detroit.

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Recognized Clinics and Foundations.—Fellowships in recognized clinics and foundations offer excellent opportunities for closely supervised training. Other clinics might well examine their facilities and consider the organization of a department of oral surgery which not only will provide valuable professional services for the group, but, if properly developed in affiliation with hospitals and postgraduate schools of universities, will materially increase the opportunities for training in oral surgery.

Selected Hospitals.—A number of hospitals which are not directly affiliated with institutions actively engaged in undergraduate or graduate teaching have organized programs of training which satisfactorily comply with all the requirements as herein stated. Some of these hospitals, utilizing their own facilities, are able to carry acceptable programs through to completion. Other hospitals of this type have supplemented their educational program, particularly in the basic sciences, with graduate and postgraduate schools. This results in a highly satisfactory plan of training and offers the greatest opportunity for the development of additional programs of training in oral surgery. Approximately three hundred hospitals have been approved by the American College of Surgeons for training in one or more of the surgical specialties. An oral surgery training program in such hospitals would require little, if any, change in basic science instruction, provided the department of oral surgery is well organized and the training program efficiently supervised.

Fundamental Requirements of Course

Duration and Objective.—To determine the exact time when the young oral surgeon is capable of assuming full responsibility in the care of patients and of beginning the practice of oral surgery in a creditable and scientific manner frequently is difficult and depends on many factors. Necessarily the facilities available in the training program, the methods of teaching employed and the response of the trainee all will affect the time that is required. However, a minimum period of time must be established as a basis for recommendation to all institutions interested in oral surgery training.

After careful and unbiased study the duration of training recommended by the American Board of Oral Surgery as the minimum period within which an adequate training program can be given is three years. Of this time, approximately one third should be devoted to instruction in the basic sciences and other subjects closely related to the oral surgery field. The remaining two years should be devoted to the clinical phase of instruction, during which time the clinical and didactic instruction is correlated in a practical way.

Since this is the major, or at least one of the most influential, specialties of dentistry it is important that it be retained as a specialty of this profession and this can be done in no other way than through the influence and acceptance of adequately trained men. Teachers of oral surgery are developed only through devoting many years to intensive study and institutional work and the great lack of training services today is due to the want of properly trained men to encourage and direct them.

Realizing that planning and re-organization will be necessary in transforming existing shorter training programs to the required minimum of three years, it is regarded as feasible by the Board to accept for examination trainees admitted to the two-year training programs prior to 1951, after which time the three-year program of training will become a requirement of application for certification by the American Board of Oral Surgery.

The objective of these training requirements is the development of an oral surgeon having a thorough background of

knowledge fundamental to this specialty and possessing skill in the technics of the many surgical procedures involved. This educational experience should contribute greatly toward raising the standard of oral surgery as an increased number of adequately trained young oral surgeons become established in practice and, with the aid of this group of trained men, future oral surgery training services should evolve.

Organization of Teaching Staff.—A well-organized teaching staff is one of the most important requisites of a good oral surgery training course. There must be a department head who will assume full responsibility for the conduct of the oral surgical service throughout the year, and it is preferable that his appointment be made on a more or less permanent basis. He should have high professional standing and possess the attributes of a teacher.

Members of the attending staff should be assigned by the head of the department to specific responsibilities in the educational program but in all instances it is essential that the head of the department be available to assume full responsibility for supervision of the work of the department. Otherwise, teaching and supervision of the work of the resident staff may be deficient.

Selection of Applicants.—The administrative and the oral surgery staff, through the appropriate committee for review of credentials, should closely scrutinize the qualifications of each applicant and give consideration to such factors as character, preliminary education, scholastic attainments in professional school and ultimate ambitions.

Character embraces honesty, sincerity, ethics, conscientious judgment, industry and all other elements which make up the background for a successful career as an oral surgeon. Honesty demands that the welfare of the patient be foremost at all times and must be evident in action, in example, in all utterances and writings and in all other contacts with patients and conferrers.

Preliminary education is also of great importance. A pre-professional college or university education is required for entrance into the majority of professional schools and is desirable in preparation for the practice of a surgical specialty. A cultural background gives a much broader appreciation of the theory of the healing arts and enables one to apply his knowledge more effectively. Applicants for training should be graduates of an approved dental school with a scholastic attainment indicative of ability to undertake study on a graduate level.

Basic Sciences.—Experienced teachers agree that supplementary work in the basic sciences should be a part of training leading to a specialization. Opinions differ, however, concerning details of acceptable plans for acquiring this additional scientific knowledge. Opinions have also differed regarding the amount of time which should be devoted to the study of the basic sciences. At times it has seemed to depend too largely on the amount of time the members of the resident staff have available in the course of their other duties to which they may be assigned. It can be stated, however, that very definite time must be set aside for this collateral study if the desired educational results are to be accomplished.

Several universities have inaugurated a school year of instruction in the basic sciences as they apply to oral surgery. Although it is recognized that the integration of the work in the basic sciences with clinical training is most desirable, the preclinical program in basic science should be acceptable. In addition to the basic sciences, instruction in other subjects closely related to the oral surgery field are given and the student is exposed to the clinical phases of oral surgery as much as time will permit. Should the trainee procure his basic science instruction under this plan, every effort should be made by the teaching staff of the hos-

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pital to continue this instruction in a practical way during his hospital residency. In the larger hospitals, in which their own facilities are used for instruction in the basic sciences, the didactic instruction can be carried concurrently with the clinical, but in all cases definite time should be set aside for the basic science instruction. Many of the smaller hospitals, through affiliation with universities, can provide the same instruction and are in a position to designate the exact place in the training program that the didactic instruction be received.

Pathology.—Those in charge of oral surgery training services should make certain that a thorough knowledge of gross and microscopic pathology is obtained by the resident staff. Instruction must be on a high level and include the oral surgical applications of general pathology with regard to degenerative processes and disturbances of metabolism, circulatory disturbances, inflammation, wound healing, infection, growth and its disorders, injuries and neoplasms. Special emphasis should be placed on the histopathology of lesions occurring in and about the oral cavity with detailed consideration of the dento-alveolar structures. In the course of clinical instruction, material removed for microscopic study should be followed through the laboratory and the pathologic findings closely correlated with the clinical history and course of the disease. Participation in, or at least attendance at, the performance of autopsies is desirable and subsequent study and review of autopsy material in clinical pathological conferences should be stressed.

Physiology.—Increasing attention is being given to physiology in the basic preparation for the practice of the surgical specialties. It represents the expanding field that is shedding new light on many of the problems encountered in surgery and the special study of this basic science is closely related to the clinical study of patients, both in fundamental interpretation of symptoms or complications and in the planning of constructive scientific treatment. Didactic instruction should be given in the essentials of hematology, including blood replacements and substitutes, fluid balance, protein and nitrogen balance, acidosis and alkalosis. A general review of circulation, respiration, renal function, absorption, digestion and metabolism should be included.

Bacteriology.—Instruction in this basic science should stress the clinical application of bacteriology to wound healing, the flora of wounds and the relation of antibodies to the treatment of wounds. The action and scope of antibiotics and their clinical use should be included. Bacteriologic laboratory technics used in diagnosis of clinical material should be reviewed, as well as sterilization and disinfection as applied to oral surgery practice. The resident staff should thoroughly utilize the educational opportunities of the bacteriologic material from the hospital service.

Anatomy.—A thorough knowledge of anatomic structure is fundamental in the practice of any surgical specialty and continuous supplementary study is desirable. The study of anatomy also may include histology and embryology and should be devoted to the applied anatomy of the head. Dissection should cover the anatomic relationships of the head and neck having practical application in oral surgery. The surgical aspects of the region under consideration should be stressed. Certain points of anatomical structure can be studied during the performance of operations and postmortem examinations and the resident staff should be accorded full opportunity of this instruction.

Pharmacology.—Instruction in this course should define and describe the principles which control and outline the factors which modify the pharmaco-dynamic action of the drugs used in oral surgery on

the mammalian organism. Particular attention should be placed on the pharmacologic action of anesthetic agents, analgesics, hypnotics, narcotics, antibiotics, disinfectants, vitamins and other drugs. Instruction in this basic science course may well be combined with that of physiology.

Radiology.—The resident staff should receive instruction in the fundamentals of roentgenology and in the interpretation and the clinical significance of these findings. The staff should be grounded in the clinical effect of radiation therapy as applied to various surgical and non-surgical conditions about the mouth, face and neck.

Anesthesiology.—This study should entail a review of the action of anesthetic agents and provide the foundation of principles underlying the administration of anesthetics in general. It should include the use of pre-anesthetic medication and the emergency treatment of anesthetic accidents, as well as post-anesthetic care in general. Whenever possible the student oral surgeon should have practical experience in the administration of general, as well as local, anesthetics. This instruction should be under the direct supervision of the anesthetist-in-charge.

In addition to the basic sciences there are many subjects closely related to the oral surgery field, instruction in which would materially implement the training of the oral surgeon. The following subjects are suggested: dermatology, with emphasis on lesions of the mouth, lips and face and oral manifestations of cutaneous diseases; oral medicine, with particular reference to non-surgical diseases of the mouth; physical diagnosis, stressing the importance of history taking, general observations and the methods of physical examination, including inspection, palpation, percussion and auscultation; speech pathology, with emphasis on the classification of speech disorders, problems and methods of speech training, rehabilitation of cleft palate patients and recent developments in clinical psychology, and general medicine, with particular emphasis on those diseases capable of producing signs and symptoms in the oral cavity. The present-day concept of the role that focal infection plays in the production of systemic disease should be reviewed. To these suggested courses of instruction others may be added that have a practical bearing on the field of oral surgery.

The program of study in the basic sciences and other related oral surgical subjects necessarily will vary in different institutions but in those in which they are presented as separate, unrelated courses they should be correlated as far as possible with clinical presentations and discussions of cases.

Hospital Service

The hospital oral surgery training service should be comprised of an adequate average census of the types of patients required for teaching in oral surgery. The amount of available clinical material must be stated rather broadly since the actual number of patients is not as important as the use which is made of those available for teaching. The status of the patients, as judged from their ability to pay, is of little value in determining the manner in which they may be used in the training program. In many hospitals, none of the patients are listed as free, the charges being paid fully by various agencies; nevertheless, all such patients are readily available for teaching purposes. The danger of losing patients as a result of the resident staff assuming supervised responsibility for their care is much more imaginary than real.

An out-patient department with systematic follow-up clinics is essential to any well-organized plan of training. The number and variety of clinics in the out-patient department will depend in a

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large part on the degree of specialization of the hospital. At least all the departments offering plans of training in the surgical specialties should have their corresponding clinics for diagnosis and the treatment of ambulatory patients. Systematic follow-up of all patients is necessary. This follow-up should be carried on either in the regular clinics of the out-patient service or, preferably, in special clinics in departments, where all patients regularly return for examination and ultimate determination of end results.

There are some hospitals in which, for various reasons, out-patient departments can not be maintained. Under these circumstances, when the institution has all of the other requisites and facilities for a satisfactory program of graduate training, a follow-up clinic should be established so that the resident staff may assume profitably a major responsibility in the examination of patients who return following their discharge from the hospital.

Assignment of Patients.—The resident staff should be assigned to a sufficient number and variety of hospital patients to assure a broad training and experience. At the same time, hospital duties in which the resident staff renders valuable professional service should not be so extensive as to prevent giving ample time for other important phases of the training program. The completeness of the preliminary study of all patients, necessary in arriving at a correct diagnosis, should be emphasized. The variety and nature of the pathologic conditions encountered also are important.

The importance of the out-patient department and its role in the training of the resident staff should be emphasized. Here there is opportunity for acquiring further knowledge and experience, particularly in differential diagnosis and ultimate determination of end results. The resident oral surgery staff should be required either to attend all clinics of the hospital service to which they are assigned or, if desirable, to devote full or part time to a series of clinics during a certain period of the training.

The major responsibilities of carrying on out-patient departmental work should not be given over entirely to the resident staff. The educational value of work in the out-patient department is largely dependent on the amount of interest displayed by the head of the department and ranking members of the attending staff. In any acceptable plan of training, they should be in attendance at the diagnostic and follw-up clinics for supervision and instruction of the resident personnel working under their direction.

Emergency Service.—All hospitals are called upon to care for a certain number of patients who present themselves for treatment in case of accidents or other emergencies. This service may vary in extent from a few patients seen in an emergency out-patient department to extensive and well-organized care for traumatic injuries in connection with the ambulance services of large hospitals. Regardless of the size of the service, advantage should be taken of this opportunity for the resident oral surgery staff to obtain experience in the care of this type of case. As the members of the staff are available in the hospital at all times, they may be called upon to take the initiative in making differential diagnosis, rendering first-aid treatment and assuming the major responsibility for the immediate care of a variety of traumatic conditions affecting the face and jaws. They must also decide when patients should be admitted to the hospital. Under proper supervision, assignment to the emergency service is a valuable experience for the resident staff.

Assignment to Operating Room Service.—The hospital training program should provide for the resident staff sufficient

operative experience, under supervision, that will lead to a sound development of technical efficiency. There should be an increasing responsibility in the operating room, both administrative and technical, commensurate with each individual's demonstrated ability to assist in and actually perform a variety of oral surgical operations. Arranging the daily operating schedule, under supervision, is usually an important duty of the senior member of the resident staff. Obviously, there is a great deal of difference in inherent ability to assist in and perform surgical operations. This should always be considered in delegating supervised responsibility in the operating room.

Unfortunately, in many hospitals entirely too much stress has been placed on the acquiring of surgical technic. Frequently the development of surgical judgment and fundamental knowledge of surgery is not given due consideration. This may be accomplished only through careful pre- and post-operative study of patients and the study of the basic sciences. Therefore, there should be a reasonable balance in the time devoted to all phases of training which will result in the ultimate objective: a well-trained oral surgeon rather than merely a surgical technician.

Opinions differ widely as to the actual number of surgical operations in which the resident staff should assist or which they should perform under supervision in order to gain a reasonable degree of technical efficiency. Having become familiar with details of the operative procedure through reading descriptions in standard textbooks, and by study of anatomic dissections on the cadaver, and then, after having carefully observed a series of operations by competent oral surgeons, a member of the resident staff will profit far more by doing one operation under the direction of a teacher than by attempting to do a large number of similar operations without proper supervision. However, it is desirable that the resident staff have opportunity to perform a reasonable number and varied types of surgical procedures during the period of training. This will inspire the confidence that is so essential when full responsibility in the care of oral surgical patients is assumed in practice, but, under no circumstances should the resident staff have privileges in the operating room either as assistants, operating under supervision, or as the responsible surgeon, which would jeopardize the welfare of the patient during the operation, or adversely affect subsequent recovery.

Clinical and Experimental Research.—Clinical and experimental research open up new avenues of thought and approach and inculcate a scientific interest in diagnostic problems. As only an occasional individual will make contributions or discoveries of lasting value, perhaps the great value obtained from doing investigative work is the exhaustive literature review connected with an actual or anticipated research problem.

As far as facilities are available, the resident staff should be encouraged to participate in clinical or experimental research. This research need not be done necessarily, at the expense of the institution furnishing the training as many clinical research projects may have such practical application that the expense is absorbed by the patients studied. The interests of the various members of the resident staff should be considered carefully when arranging assignments to this activity inasmuch as ability and desire to do this type of work differ widely. Intelligent direction and supervision of research should be provided both in the choice of the problem and in the various phases of its development. There should be reasonable assurance that the problem investigated will justify its cost in effort, time and use of experimental animals and other material. In some instances a research problem carried to completion may furnish the subject mat-

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ter for the thesis required in many training programs. In other instances in which unusual ability and desire on the part of the trainee is demonstrated, it may be the stimulus for continued study in this line of endeavor.

Library Facilities.—The scientific library plays an extremely important role in postgraduate training. Every hospital should maintain a basic collection of carefully selected, authoritative textbooks of the latest edition. The library also should contain current medical and dental journals and works of reference in the various branches of medicine and surgery in which a training program is being conducted.

The educational program in oral surgery training should include an organized plan which requires reading of scientific literature by the resident staff. There are several successful methods of conducting literature reviews. Each member of the resident staff can be asked to make a comprehensive review of the important articles contained in one or more journals and report regularly. The plan may be supplemented by assignment of a specific subject or disease entity to one or more of the participants for a complete review of the related past and current literature. A supervised program of reading and reviewing the current professional literature should be arranged for each member of the resident staff.

Staff Conferences.—Departmental conferences with members of the other surgical specialties are desirable for discussions of mutually related problems in the diagnosis and treatment of patients. All deaths, unimproved cases, wound infections, errors in diagnosis, patients presenting special problems, and other aspects of the clinical activities of the department should be considered and thoroughly reviewed.

Clinical Pathological Conferences.—The resident oral surgery staff should attend all clinical pathological conferences as well as participate actively in those of their own department. The program should include the demonstration of pathologic material from the operating room and from autopsies.

General Staff Meetings.—The educational value of well-conducted staff conferences has been demonstrated for many years in connection with a program of hospital training. The purpose of the conference is to review critically and analyze the clinical work of the hospital. All members of the resident oral surgery staff should be required to attend staff conferences at all times, except those which are held in departments where the programs would be far removed from their interest. Participation in the conferences by the resident staff should be more than a brief presentation of a patient's history. The presentation of case reports should always be preceded by careful study and correlation of the reports with the literature. The resident staff should be encouraged to participate in the discussions when their opinions are based on extensive study of the subject. Under proper guidance, the staff meeting becomes an important place for self-expression which is significant in the development of the oral surgeon.

Recommendations

It is recommended that a directory of approved plans, with descriptions of the main features thereof, be published as soon as they are agreed on. This directory will be invaluable to members of the dental profession in making plans for training in oral surgery. The directory also will serve the purpose of stimulating and guiding additional hospitals in making plans for training in oral surgery and serve as a reference in formulating such plans. It is extremely important that as many institutions as possible formulate such plans at an early date, in order that

appointments to approved oral surgical residency may be made available to a larger number of dental graduates. This is essential, both in fairness to the individual who desires oral surgery training and to the public which must be given constantly improving oral surgical services.

It is also recommended that a committee, to be known as the Field Survey Committee, be appointed to investigate, analyze, evaluate and list the several training centers existing at the present time. Such a list will be of great value to those desiring oral surgery training. This committee could also be of material aid to hospitals in inaugurating and improving training programs in oral surgery.

Conclusion

There is a marked trend in all fields of health service toward better preparation for a professional career. Also, there is a growing demand by the public that operations be done only by those having training and experience. This applies to all of the other fields of medical and dental practice as well. There is also a trend in hospitals to have positions of responsibility, on the medical and surgical staff, occupied by recognized specialists in their respective fields.

The American Board of Oral Surgery views the problem from the standpoint of oral surgery with a definite belief that training in this field can be adequate only if it is obtained through organized, supervised work and in accordance with the requirements laid down in the program promulgated by this study. There is no one mold or standard method by which all oral surgeons may attain this goal, but the training and experience of each must be carefully evaluated with respect to the period of training, the institution in which it was obtained and the quality of the training received.

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Detachment from Clamor.—I like to think that were Osler with us today he would resist the allurement of the song of the siren of Politics and even, if need be, order his sailors to bind him to the mast of his ship until the danger was past. It is clear to me, from talks I had with him as well as from his published essays, that an attitude of dignity and calm detachment would have characterized this great custodian of Medicine in face of the threat of political pressure.

I have more than once, in my own fashion, preached this gospel. "It is paramount that we remain detached from the general clamour . . . political clamour, the clamour of 'left' and of 'right.' For Medicine there can be no left or right. For Medicine there is only expert knowledge and a rooted adherence to truth. . . . Detachment, public confidence, courage—these are the essentials that enable Medicine to make its contribution to the common Health and Happiness."

One of the finest tributes to the heritage of which we are the trustees was that of Karl Marx: "For thousands of years," he said, "Medicine has united the aims and aspirations of the best and noblest of mankind. To deprecate its treasures is to discount all human endeavor and achievement as naught."

As a humanist I passionately want to see this great heritage placed at the disposal of my fellow men. It is a pity that the present effort of the State to bring this about has so largely failed of its purpose. It might have been a great success. We must still labor to make it so.—*Lord Horder, Brit. M. J., Apr. 2, 1949; J. Canad. D. A., 15:381 (July) 1949.*

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LON W. MORREY, D.D.S., *Editor*

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EDITORIALS

NINETIETH ANNUAL SESSION OF THE ASSOCIATION: OCTOBER 17-20, 1949

THE Ninetieth Annual Session of the American Dental Association scheduled for San Francisco on the 17th to 20th of the month promises to be one of the finest meetings in the history of the profession. Approximately 75 essays on various aspects of dentistry will be presented in eight section halls of the spacious civic auditorium; 35 scientific exhibits, 135 technical exhibits, 50 motion pictures and about 175 table clinics will complete the comprehensive scientific program. The 385 delegates and their alternates will meet at the Fairmont Hotel to conduct the business and legislative affairs of the Association, elect officers and chart the course of the organization for the coming year.

Although the Council on Scientific Sessions will present a particularly heavy program and members of the House of Delegates also face a heavy schedule, members and their families are assured that the meeting will not be all work and no play. The Committee on Local Arrangements has promised ample entertainment of a kind that San Francisco alone can provide and for which it is internationally famous.

This year's session will be a far cry from the first convention held by the Association at Niagara Falls in 1859. It is inconceivable that even the most imaginative of the 26 dentists who founded the Association at that time could have visualized the growth and progress which the organization would enjoy within the short space of less than a century: plastic materials that replace vulcanite rubber for dentures, anesthetics that eliminate pain without eliminating complete sensibility, antibiotics

that control infection, chemicals that partially control dental decay, cast precision attachments and restorations of infinite fineness; all of which are now commonplace to every practitioner. Nor is it conceivable that any one of the Association's founders visualized that some day these and other marvelous developments would be demonstrated by equally marvelous means: the motion picture, the television and the radio.

Dentists of today are indebted to the countless men and women, both within and without the profession, whose contributions have made it possible for dentistry to provide the present high standard of service to the public. The Council on Scientific Sessions is to be congratulated for bringing together and presenting the latest and best of these contributions at the San Francisco meeting.

FUNDS FOR TOPICAL FLUORIDE PROGRAM SHOULD BE MADE ON GRANTS-IN-AID BASIS

WHEN Congress considers appropriations for the next fiscal year, the American Dental Association will urge the federal legislative body to place the present national topical fluoride program on a state grants-in-aid basis. A full explanation of how the present demonstration project is being administered is given by John W. Knutson on page 438 of this issue.

The program currently is being conducted by the United States Public Health Service in 35 states and territories, including Alaska, Hawaii, Puerto Rico and the District of Columbia. It is administered in cooperation with the state health departments and state dental societies. A mobile unit staffed by a dentist, two dental hygienists and a clerk is assigned to each of the participating states. Each team operates under the general direction of the Public Health Service, although it functions under the immediate supervision of the dental director of the state health department. The project is designed to stimulate wider use of topically applied sodium fluoride to the teeth of children in order to reduce the incidence of dental caries and raise the national standard of dental health. Financed the first two years by an annual Congressional appropriation of approximately $1,000,000, it becomes the first instance in which Congress has made provision for financial support of a specific dental program on a nationwide basis.

There is no question as to the desirability of educating the public regarding the effectiveness of the topical fluoride technic. There is some question as to the desirability of having the project, which can easily develop into a treatment program, administered from the federal rather than the state level.

At its February 1949 meeting the Board of Trustees of the Association, acting on a recommendation of the Council on Dental Health, "directed the Council on Legislation to approve the further appropriations by Congress for continuing the

topical fluoride experimental program of the United States Public Health Service only on the basis of a grants-in-aid program to individual states."

It is extremely unfortunate that the Congressional appropriation for this worthwhile project was not set up originally on a grants-in-aid basis rather than as a direct appropriation to a federal agency. Even though, as Dr. Knutson points out, the United States Public Health Service and Congress view the program as a temporary demonstration project, it may establish a pattern which will enable federal agencies to encroach on the duties and responsibilities of state departments of health. The dental units in most state health departments are capable of administering projects of this kind and they should be given that responsibility.

Any program, no matter how worthwhile, that tends to relieve the local community and the state health authorities of their full share of responsibility in health matters must be viewed with concern. It is hoped that Congress, in making further appropriations for this demonstration project, will do so on a grants-in-aid basis.

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INTERNATIONAL CORRESPONDENCE

NEWS FROM THE NETHERLANDS

It is felt by the Committee on Social Dentistry of the Netherlands Dental Association that an inaccurate and warped view of the development of "social dentistry" in the Netherlands has been presented to the dental profession in the United States through an article by Charles F. L. Nord, D.D.S., of Amsterdam, which appeared in the May issue of THE JOURNAL. The article, entitled "The National Dental Health Program of the Netherlands," deals only with the so-called "Amsterdam solution" to the problem of social dentistry which at best must be considered an arrangement among a few dentists on the local level that has resulted in the slight improvement of an ailing dental care program.

The method for providing dental care under the comparatively new—since the war—compulsory health service given by Dr. Nord is especially distasteful to the majority of dentists in the Netherlands in that it involves an employee status for the dentist. This condition prevails in Amsterdam and is considered a form of socialized dentistry which will not benefit the public.

In the Netherlands, as in many other European countries, what were originally called "doctors' funds" set up to aid the physician and dentist in treating persons of low income eventually were absorbed by the "sick funds" which until the war operated in a fashion similar to voluntary health insurance. The assistance given dentistry through these funds proved to be insufficient with the years, however, and in 1929 the dental profession projected its first baseline or policy for restoring dental health. Under this policy dental treatment for the so-called "not private" patients was to be provided only for those who could meet certain oral health standards. Patients would not receive fillings if they needed extractions, they would not receive dentures if they needed fillings. It was apparent under this system that the dental health of the patients was improving but the real need lay beyond the scope of any insurance scheme.

It was obvious that treatment should begin at an earlier age than was the case and that reduction of dental neglect in a ratio equal to the increasing dental-mindedness of the public were the basic issues. The Netherlands Dental Association, therefore, in March, 1949 approved a new plan based on the premise that (1) a certain portion of the funds allocated for dental service were to be used in a school dental program and preschool dental program, and that (2) a separation was to be made between the dentally-fit and dentally-unfit. This latter point is, in effect, an incorporation of the idea behind the 1929 policy.

This new "rational plan for restoring the dental health" provides that everyone who participates in a "fund" whether under the compulsory system or not has a right to emergency treatment without extra payment. School children who are regularly inspected from 6 years of age and those others who are dentally fit should be entitled to operative dentistry without extra payment.

The dentally unfit, while having the right to operative dentistry under the Association's plan, would be required to pay completely for their operative dental treatment which it is believed would lead to an increase in the dentally fit. Also under the scheme, the dentally fit are entitled to artificial dentures.

In the case of school children and other groups where the dentally fit and unfit have clearly been separated, orthodontic treatment would be given under the plan and remuneration would be on a payment per operation basis.

The first steps have been taken in the development of a school dentistry program under the direction of the Netherlands Dental Association, the "funds," local government authorities and representatives of the schools. School dentistry has been or is being introduced in several urban and rural districts.

As planned, each student will be examined twice a year and treated if necessary so that

Secretary, Committee on Social Dentistry of the Netherlands Dental Association.

when he leaves school after six years, his dental health will be good. Then as either a member of a compulsory or voluntary insurance scheme, he will be entitled to maintenance treatment provided he continues to make two yearly visits to the dentist.

It should be pointed out in view of Dr. Nord's article that of the two cities, Amsterdam and Rotterdam, it is Rotterdam that has had school dentistry since September, 1946. While proposals still are being discussed in Amsterdam, a definite program is in operation in Rotterdam and several other places.—*P. H. Poppinga, Rotterdam.*

NEWS FROM GREAT BRITAIN

The problem of frequent disunity within the nation's dental profession occasioned by the existence of three distinct national dental associations is expected to be solved through the forthcoming amalgamation of these organizations under the title of the British Dental Association. It is expected that the merger will be completed by January 1.

The value of professional unity has overcome the differences which kept apart the Incorporated Dental Society, composed of dentists who practiced before modern academic standards were instituted, and those who belonged to the Public Dental Service Association and the B.D.A. This is evidenced in approval by the three dental association's governing bodies of the report of the Amalgamation Drafting Committee. Each organization must now get its members to approve.

The B.D.A.'s present constitution, according to the report, will be rewritten in the interest of providing equal participation in the new Association's affairs by the other two groups. The governing bodies of all three organizations will be charged with managing the new Association during the first year.

Since the lack of a common program is considered one of the major problems being faced by British dentistry, creation of the new association is considered an important move.

The Penman Report

Although the government's limitation of earnings regulation was removed on July 31, the Penman Report, a time and motion study on dental operations ordered by the government, is still awaited. It is being printed but no publication date has yet been released.

Impatience over the tardiness of publication of the Penman Committee findings, however, is mild in comparison with the attitude of many on the School Dental Service. This important phase of maintaining dental health among children and expectant mothers has been hard hit by the National Health Service.

The B.D.A. recently reported on 21 local school dental authorities with a combined authorized establishment of 212 dentists which creates a ratio of about one dentist to 4,000 children. At present only 98.5 dentists are employed, or an equivalent of one dentist for 9,000 children. These dental officers also are required to serve in maternity and child health clinics and to provide emergency treatment.

In one town with a population of 10,200 none of the three local dentists is serving in the school program while in another area with 13,000 children a half time dentist is attempting to provide the school service. Worst of all, perhaps, is Birmingham where the ratio is one dentist for 18,333 children.

Considerable heat was generated in Parliament recently by the Socialist M.P. for Rotherhithe district, London, when he told the lawmakers that the deplorable conditions in his own constituency were common throughout the country. "The resignation of this full-time dental surgeon from the clinic [the School Health Service Clinic] on March 31 added one more to some 25 similar problems throughout the County of London—that of finding replacements," he said. He also predicted that unless something is done to improve school dentist recruiting the entire Service will "perish." A common system of remuneration for all dental practitioners was urged as the only solution to the problem.

Periodontists Organize

On July 19 the first members and officers of the new British Society of Periodontology were elected. E. W. Fish, C.B.E., M.D., F.D.S., is the president. The secretary may be reached at The Institute of Dental Surgery, Eastman Clinic, Gray's Inn Road, London, W.C.1.—*John R. Boyes, Newcastle-Upon-Tyne.*

THE NATIONAL SCENE

from The Journal's Washington Correspondent

September was the quietest month of the year thus far, with respect to governmental developments affecting the dental profession, but this lull may well be regarded as that which precedes—if not a storm—then at least some lively action. Revival of arguments over national health insurance on Capitol Hill this fall and winter is assured as the result of the inspection trip in the British Isles and Europe which was to be completed on Sept. 26 by 16 members of House Interstate and Foreign Commerce Committee. The bipartisan effort for federal support of dental schools and student scholarships is nearing a climax. The ensuing year undoubtedly will achieve a high point in government grants-in-aid for dental research in civilian institutions, with funds provided by Public Health Service, Army and Navy. Attraction of Veterans Administration for dentists will be heightened if the Senate follows the House lead and passes legislation increasing salary scales for professional personnel.

Aid To Education An Issue

Other issues in the lap of Congress, which must be handled either before adjournment of the present attenuated session or at the second session in 1950, include school health services legislation; the proposal to establish a Department of Health, Education and Security; granting of authority commensurate with responsibility for the Army Dental Corps, and increased federal assistance for local public health units throughout the country.

Late in September, National Institutes of Health (research arm of Public Health Service) announced the award of six dental research grants, aggregating $22,897. Recipients are University of Southern California, $9,843; Jewish Hospital (Brooklyn, N.Y.), $6,048; University of Chicago, $3,456; University of Oregon, $1,462; Ohio State University, $1,575, and New York University, $513. Applications for additional grants will be considered by the Dental Study Section, meeting Oct. 15 in San Francisco in conjunction with the 90th annual session of the A.D.A., and acted upon in Washington Nov. 4 at the meeting of the National Dental Research Advisory Council.

Army Reviews Research

Incidentally, a decision to about-face on caries research was made at the Sept. 10 meeting of the Army Dental Research Advisory Committee. It will recommend to the Army Medical Research and Development Board that all or most of the investigations in this field now being conducted at Army facilities be brought to a close and a fresh start made in the fiscal year beginning in July, 1950. Details are unavailable, pending action to be taken on the recommendations by the Research and Development Board and National Research Council. Civilian members of the advisory committee are Robert G. Kesel, University of Illinois; Hamilton B. G. Robinson, Ohio State University; George Paffenbarger, National Bureau of Standards, and Henry Swanson, of Washington.

Fees paid to private dentists by Vet-

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erans Administration during the fiscal year ended June 30, 1949 totaled $38,813,560, according to the recently released annual report. This figure is approximately 23 per cent below that for the previous year. There is a distinct likelihood, however, that the present fiscal year will witness a sharp increase. Reports are gaining headway that the V.A. plans to close 132 regional offices and eleven sub-regional offices. If this is done, it will bring about a marked reduction of dental work performed by V.A. staff men and consequent increase of fee-for-service work by private practitioners.

Meantime, 1949-1950 also is expected to see the Army utilizing private dentists more than ever before in peacetime. At present, it employs 128 on a full time basis and 47 part time, exclusive of 144 in Germany, Japan and other overseas posts. Since Army Dental Corps strength is only about fifty per cent of normal, all indications are that advantage will be taken of Congressional authority permitting both hiring of civilian dentists on a staff basis and contracting with them for fee-schedule services.

New Division In U.S.P.H.S.

Under the directorship of James F. Lewis, the newly established Division of Dental Resources in U.S. Public Health Service is in process of organization. Several key posts still remain to be filled and, as a result, functioning of the division at a normal pace has been delayed. Dr. Lewis was transferred from his duties as senior dental officer of the Coast Guard to head the division, which will be concerned with clinical, as distinguished from preventive care, problems.

Considerable interest has been aroused, both locally and nationally, by the disclosure that Brookings Institution of Washington has begun a comprehensive survey of health services in the United States. Dental, medical and hospital services as provided on a straight fee basis, through prepayment plans, by industrial coverage and by federal, state or local benefits—all will fall within the survey's scope. The A.D.A. is one of many national organizations being asked to cooperate in the study, which it is estimated will take at least two years to complete. Findings and recommendations are to be published.

V.A. To Sponsor Fellowship

National Bureau of Standards, a major center of research in dental materials, an appreciable share of which is supported by American Dental Association, is to be joined in this field by Veterans Administration. The latter has announced that arrangements have been completed for a one-year fellowship for training in methods of investigating physical, chemical and engineering properties of dental materials. Applicants for the position must have a background in physics or chemistry and an aptitude for research. They need not be members of the V.A. dental service. On completion of training, the individual will be assigned to veterans dental clinics.

The two-week European inspection tour of national health insurance systems, begun in London on Sept. 12, had the following Congressional participants: Democrats — Reps. Robert Crosser (Ohio), Lindley Beckworth (Texas), Arthur G. Klein (N.Y.), John B. Sullivan (Mo.), John A. McGuire (Conn)., Andrew J. Biemiller (Wis.), Thomas R. Underwood (Ky.), George H. Wilson (Okla.) and Neil J. Linehan (Ill.); Republicans—Hugh D. Scott and Wilson D. Gillette (Pa.), Leonard W. Hall (N.Y.), Joseph P. O'Hara (Minn.), John B. Bennett (Mich.), Harris Ellsworth (Ore.) and James I. Dolliver (Iowa). Their itinerary called for five days in the British Isles, three in Sweden, one each in Germany and Switzerland and two days each in Italy and France. On their day of arrival in London, the group was

received by Health Minister Aneurin Bevan. Which brings up an interesting point: A lower cuspid of British Foreign Minister Bevin is now the property of the A.D.A. It was extracted in Washington on Sept. 8, when Bevin was in the Capital for monetary conferences, and a week later it was forwarded to the Army Medical Museum for deposit in the A.D.A. collection which is kept there.

LEGISLATION

V.A. REPORTS FAVORABLY ON TWO A.D.A. SPONSORED BILLS

Two A.D.A. sponsored bills, H.R. 3208 and H.R. 3209, received favorable reports from the Veterans Administration during September. The first of the two measures would create a specialist grade for dentists in the V.A. health set up while the second would change the wording of an existing V.A. law from "doctors of medicine, dentists and nurses" to read "doctors of medicine, doctors of dentistry and nurses." This is the first positive action taken by the V.A. on a series of three Association bills, the last of which (H.R. 3210) creates a chief grade for V.A. dentists, thereby placing them on a pay scale comparable to that afforded physicians.

A more equitable pay schedule for dentists in the V.A. also is contained in the Allan bill (H.R. 6320) which has been passed by the House of Representatives and now is before the Senate Committee on Labor and Public Welfare. This bill would increase health personnel salaries throughout the agency. The Committee was urged by the A.D.A. last month to recommend the bill for passage, according to Francis J. Garvey, secretary of the A.D.A. Council on Legislation.

It was pointed out by Mr. Garvey that the Association's specific request for establishment of the chief grade was commented on favorably by the House committee which considered it as a point in the Allan bill. Both the House and Senate were expected to resume serious consideration of a number of other measures related to the health professions late last month.

COPIES OF TESTIMONY ON A.D.A. ARMY DENTAL BILL AVAILABLE

A limited number of copies of A.D.A. and Army testimony on the Association sponsored Army dental bill given at hearings in Washington in June are now available, according to Francis J. Garvey, secretary of the Council on Legislation. This material may be had free of charge by writing the Council, 222 E. Superior St., Chicago 11.

RESEARCH

SITE FOR NATIONAL DENTAL RESEARCH INSTITUTE CHOSEN

A site has been chosen and plans now are in the drawing board stage for the new building which will house the National Dental Research Institute at Bethesda, Md., Bruce Forsyth, assistant surgeon general for dentistry in the U.S. Public Health Service, has disclosed. The structure is to be erected on the north side of the area occupied by the National Institute of Health.

Although the law establishing the Institute set initial cost at $2,000,000, only $100,000 has been appropriated so far. Congress, however, is expected to appropriate the required funds for construction at its next session. At present the Institute is housed in quarters provided by the National Institute of Health, and is operating under the direction of H. Trendley Dean.

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A. D. A. AFFAIRS

HOUSE OF DELEGATES TO SET ASSOCIATION POLICY AT NINETIETH ANNUAL SESSION

The A.D.A. House of Delegates, convening in San Francisco for its 90th annual session Oct. 17, is expected to give major attention to intensification of the Association's program against enactment of compulsory health insurance among many other policy matters. This will be the first meeting of the House since the national election last fall and since defeat of the administration's attempt to establish a cabinet status department of health and welfare probably headed by Federal Security Administrator Oscar Ewing, most outspoken champion of Thomas-Murray-Dingell legislation.

Points To Be Discussed

In addition to a reiteration of the A.D.A. stand against compulsory health insurance, the House likely will consider plans relative to the Association's recently established program of public information designed to inform the profession and the public of the facts on compulsory health insurance. Ways and means of extending dental health services to more people, especially children, also will be on the agenda.

Other issues the House will deal with include Association sponsored legislation to improve conditions in the Army and Air Force dental corps which emphasizes "authority commensurate with responsibility" for dental officers in administration of the dental service. A modified version of this legislation has been passed by the U.S. Senate and now awaits action in the House of Representatives. A reorganization of the Armed Forces medical services now being planned in the Department of Defense may also be an important factor in deliberations of the House.

Size Of House A Factor

Reduction in the size of the Association's legislative body probably will be reviewed by the 385 delegates who will constitute the second largest House of Delegates in history. The largest was last year's 390 member body. In recent years several proposals have been advanced to reduce the size of the House through revision of the formula by which constituent societies are allotted delegate quotas.

At present the formula calls for one delegate for each 25 to 99 constituent society members, one delegate for the next 200 members or fraction thereof and another delegate for each additional 200 members. Held over for action this year from the 1948 meeting held in Chicago, is a Southern California State Dental Association plan whereby the size of the House would be cut about 40 per cent. A special committee recommended that the present 100 member requirement for allocation of the second delegate be boosted to 200 and that the third delegate be added when the membership exceeded 400 instead of the presently required 300. For a fourth delegate the requirement would be double the present number, or 400.

The Oregon State Dental Association since that time, however, has proposed a 25 per cent reduction. Under this plan present regulations would be in force up to the 700 member mark and would require an additional delegate for each ad-

ditional 400 members instead of the present 200.

Also scheduled for consideration by the House are recommendations of the Council on Dental Trade and Laboratory Relations related to state legislation for licensing and registration of laboratory technicians. A report of the special committee to survey the affairs of the Association, which is contained in the 1949 Reports of Council and Officers now in the hands of all delegates and their alternates, will be reviewed and action will be taken on the Association's budget for 1950. Presiding over the House for the first time will be a speaker, Percy T. Phillips, of New York. Clyde E. Minges, president of the Association, will preside at the meeting of the Board of Trustees which begins a week prior to convening of the annual session.

All persons traveling into California by rail to attend the 90th annual session of the A.D.A. will be required to validate the return trip portion of their tickets, according to the Transcontinental Passenger Association. This rule applies to the entire west coast and in order to facilitate servicing of the convention goers, the Passengers Association will maintain a booth adjacent to the A.D.A.'s registration booth in the Civic Auditorium, San Francisco.

Voting machines will again be used in the election of new officers and trustees on the morning of Oct. 20. The positions to be filled in the election include those of the president-elect to succeed Philip E. Adams, of Boston, who ascends to the presidency; the speaker of the House, who is elected annually; three vice-presidents, and trustees for the 1st, 6th, 7th and 10th districts whose three-year terms expire this year. Trustees for these districts at present respectively are: Henry Hicks, Greenwich, Conn.; Robert P. Thomas, Louisville, Ky.; J. B. Carr, Indianapolis, and C. S. Foster, Cedar Rapids, Ia.

Offices To Be Filled

Council members whose terms expire this year and which will be filled by election of the House include: J. D. O'Farrell, Houston, Texas, Council on Constitution and Bylaws; F. J. Houghton, Jersey City, Wilbert Jackson, Clinton, N. C., and R. W. McNulty, Chicago, all Council on Dental Education; Lloyd H. Dodd, Decatur, Ill., and Walter A. Wilson, Jersey City, Council on Dental Health; Grant Van Huysen, Indianapolis, Council on Dental Museum and Registry; M. K. Hine, Indianapolis, Council on Dental Research; H. T. Knighton, St. Louis, Council on Dental Therapeutics; Herbert W. Mason, Indianapolis, Council on Dental Trade and Laboratory Relations; R. H. Friedrich, Plainfield, N. J., Council on Federal Government Dental Corps; W. G. Adair, Cincinnati, Council on History; T. A. Hardgrove, Fond du Lac, Wis., Council on Hospital Dental Service; F. A. Richmond, Kansas City, Kan., Council on Insurance; Paul E. Jones, Farmville, N. C., Council on International Relations; G. W. Matthews, Birmingham, Ala., Council on Journalism; H. O. Lineberger, Raleigh, N. C., Judicial Council; Carl O. Flagstad, Minneapolis, Council on Legislation; H. C. Jarvis, Cincinnati, Council on Membership; Thomas M. Birkbeck, Milton, Ore., H. M. Marjerison, Boston, and C. E. Matteson, Tucson, Council of National Board of Dental Examiners; M. C. Hansen, Racine, Wis., Council on Relief, and R. W. Frost, Kansas City, Mo., Council on Scientific Session.

Advisory Committee members whose terms expire this year are: J. F. Volker, Arlington, Mass., Advisory Committee to

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the Bureau of Chemistry; H. E. King, Omaha, Advisory Committee to the Bureau of Economic Research and Statistics; Robert E. Sargent, Bristol, N. H., Advisory Committee to the Bureau of Library and Indexing Service, and W. L. Barnum, Portland, Ore., Advisory Committee to the Bureau of Public Information. These memberships also will be filled by election of the House.

Positions left vacant during the last year by death or resignation on a number of Councils and Advisory Committees will be filled by the House. Chairmen of Councils and Committees for the coming year will be named by the Board of Trustees.

U. S. SENATOR AND DEFENSE OFFICIAL TO SPEAK TO A.D.A.

Among the principal speakers at the general meeting of the 90th annual session of the A.D.A. will be U. S. Senator Lester C. Hunt (D., Wyo.), A.D.A. President Clyde E. Minges has announced. He is expected to present an up-to-the-minute report on health legislation before Congress.

It also has been disclosed that Richard L. Meiling, who was to succeed Raymond B. Allan as director of medical services for the Department of Defense on Oct. 1, will speak to the House of Delegates Oct. 17.

TWO ASSOCIATION OFFICIALS TO BE HONORED IN SAN FRANCISCO

Among the special entertainments which will be held during the 90th annual session, in San Francisco, are a testimonial luncheon for Roscoe H. Volland, past-president and former treasurer of the A.D.A., and an "International Night" dinner dance in honor of Clyde E. Minges, retiring A.D.A. president.

The luncheon for Dr. Volland will be held Oct. 17, at the Fairmont Hotel. A committee headed by Leo W. Kremer, of Chicago, A.D.A. vice-president, is credited with planning the affair. Reservations may be secured by contacting Dr. Kremer at 55 E. Washington Blvd., Chicago.

A cocktail party, dinner, Hollywood floorshow and dance are the main events scheduled for the International Night celebration honoring Dr. Minges. This affair, plus a series of tours including one to the Hunter's Point Navy yard, were planned by the Committee on Entertainment of the Committee on Local Arrangements. Reservations for all but the special ladies' events are being handled by Leon Moser, entertainment chairman, 450 Sutter St., San Francisco 8. The ladies' events are under direction of Mrs. R. L. Blake, 3700 Ocean Ave., San Francisco 16.

STATE OFFICERS CONFERENCE TO BE HELD BY A.D.A. OCT. 16

The Annual Conference of State Society Officers of the American Dental Association will be held Oct. 16, immediately preceding the opening of the Association's 90th annual session, in San Francisco. Walter T. McFall, of Asheville, N. C., president of the North Carolina Dental Association and conference president, will preside.

To be held in the Red Room of the Fairmont Hotel, the Conference is open to all constituent dental society officers and editors. There will be morning, afternoon and luncheon sessions.

Speakers scheduled for the morning session include Charles A. Wilkie, of Brooklyn, secretary of the Dental Society of the State of New York, who will discuss "problems of the dental technician and dentistry," James M. Robinson, of Los Angeles, executive secretary of the Southern California State Dental Association, who will speak on "state dental

program planning," and E. J. Justis, of Memphis, secretary of the Tennessee State Dental Association, who will talk on "the duties and functions of a paid executive secretary for a state dental society."

The afternoon program will include a discussion by Francis J. Garvey, of Chicago, secretary of the A.D.A. Council on Legislation, on "the impact of current legislation upon American dentistry," and a talk by Philip E. Adams, of Boston, A.D.A. president-elect, on the direction dentistry will take in the future. Audience participation in discussions of each point covered in the program is expected. Election of officers and the annual business meeting of the Conference will be conducted at the start of the morning session.

BOOK LIST SUPPLEMENT IS AVAILABLE THROUGH LIBRARY

A new supplement to the Association's list of books available through the library may be had free of charge upon application to the Bureau of Library and Indexing, 222 E. Superior St., Chicago 11, according to Donald Washburn, Bureau director. The supplement lists all books published and received in the library up to June 1.

REFERENCE COMMITTEES FOR ANNUAL SESSION ORGANIZED

Appointment of members of the Committee on Credentials and the 13 Reference Committees of the A.D.A. House of Delegates for the 90th annual session has been completed by Clyde E. Minges, Association president. Reference Committee appointments have been distributed equally among the 13 trustee districts, each district having three Committeemen.

Appointees to the standing Committee on Credentials by state dental societies are: Paul W. Zillmann, New York, Chairman; John R. Abel, Southern California; and Don M. Hamm, Arkansas.

Reference Committee appointees by state dental societies and their Committees are:

Constitution and Bylaws.—Sanford Ballinger, Utah, chairman; Earl P. Boulger, Illinois, and T. H. McAllister, Oregon.

Dental Education.—Willard S. Bell, New York, chairman; M. E. Lusk, Minnesota, and George M. Anderson, Maryland.

Dental Research.—H. O. Warrick, Oklahoma, chairman; Carl O. Boucher, Ohio, and B. M. Tylicki, Southern California.

Dental Trade and Laboratory Relations.—F. A. Pierson, Nebraska, chairman; J. S. Eilar, New Mexico, and John H. Carter, New York.

Federal Government Dental Corps.—H. Mesjian, Pennsylvania, chairman; Glenn E. Cartwright, Illinois, and G. A. LeSage, Wisconsin.

Hospital Dental Service.—G. W. Christiansen, Michigan, chairman; C. A. McMurray, Texas, and Michael B. Messore, Rhode Island.

Insurance.—A. J. Fillastre, Florida, chairman; Walter A. Crum, Indiana, and A. B. Coxwell, Kentucky.

Legislation.—John W. Green, Illinois, chairman; W. Earle Craig, Pennsylvania, and George D. Greenwood, New York.

Miscellaneous Business.—Arno M. Bommer, Massachusetts, chairman; C. S. Renouard, Montana, and O. J. Merwin, Minnesota.

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Public Health.—Oren A. Oliver, Tennessee, chairman; D. W. Brock, Missouri, and Fred Wertheimer, Michigan.

Reports of Officers.—Carlos H. Schott, Ohio, chairman; Harry Bear, Virginia, and J. S. Oartel, Pennsylvania.

Rules and Order.—Glenn C. Anderson, Iowa, chairman; T. Ford Leggett, Mississippi, and Eugene R. Westcott, New Jersey.

Scientific Session.—David J. Fitzgibbon, District of Columbia, chairman; Lawrence R. Ludwigson, California, and Henry T. Quinn, Connecticut.

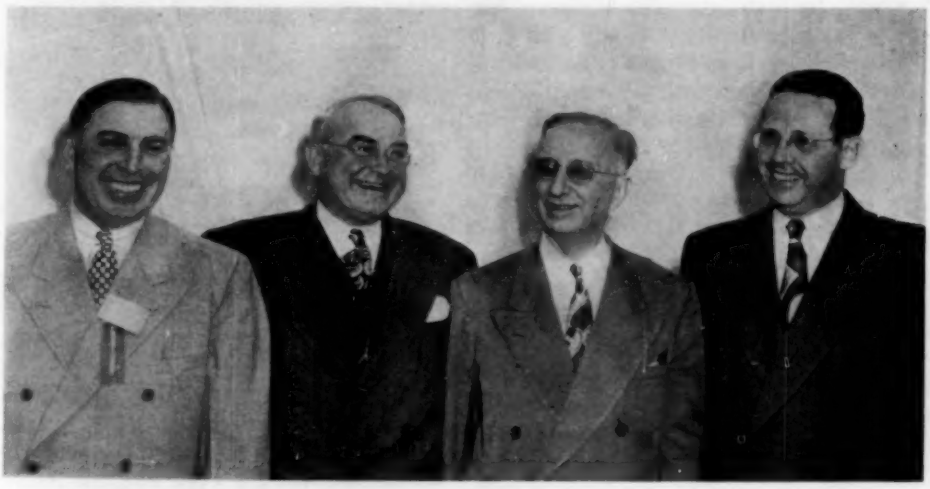
Open hearings will be conducted by these committees on Tuesday, October 18.

RADIO NETWORK TO PRESENT ROUND-TABLE ON DENTISTRY

In connection with the 90th annual session of the A.D.A., Oct. 17-20, in San Francisco, the National Broadcasting Company will present a panel of four prominent dentists in a discussion of current subjects in dentistry at 12:15 Eastern Standard Time, Oct. 15.

Scheduled to participate in the round-table discussion are Philip E. Adams, of Boston, president-elect of the A.D.A.; Harry Lyons, of Richmond, Va., chairman of the Special Committee on National Emergency Dental Service; Willard C. Fleming, dean of the University of California dental school, and Alfred E. Seyler, of Detroit, editor of the *Journal of Dentistry for Children.*

DENTAL SOCIETIES



During his year as president of the A.D.A., Clyde E. Minges toured the nation attending state dental society meetings, including that of the Indiana State Dental Association, in Indianapolis. In the photo are: (left to right) Herbert W. Mason, immediate past-president of the Indiana Association; Dr. Minges; J. B. Carr, of Indianapolis, A.D.A. trustee, and Frank H. O'Halloran, new president of the Indiana Association.

DENTISTRY TO PARTICIPATE IN PENNSYLVANIA BLUE SHIELD PLAN

Adequate participation of Pennsylvania dentists in the state Blue Shield Plan's program for providing certain dental treatment for hospitalized patients is "practically assured," the Pennsylvania State Dental Society reports. The inclusion of dentistry in the prepaid surgical insurance field was approved by the last State Legislature.

Plans for the implementation of the new program were made jointly by Blue Shield and the State Society's committee on hospital dental service, headed by John Looby, of Philadelphia. The bills amending the state law to permit inclusion of certain restricted dental services, sponsored by the Society, define the dental services which may be paid for by Blue Shield as "the general and usual services rendered by doctors of dental surgery serving in the capacity of staff members of an accredited hospital, provided these services are rendered in an accredited hospital."

Payments for services rendered under the plans is on the fee schedule basis and is handled by Blue Shield. The dentist, physician or osteopath, however, is left responsible for determination of the patient's income.

COMPULSORY HEALTH INSURANCE IS TOPIC OF NEW YORK MEETINGS

A series of nine special district dental society meetings on compulsory health insurance sponsored by The Dental Society of the State of New York got under way Sept. 19, in Albany, under the direction of the State Society's committee on compulsory health insurance, headed by Donald H. Miller. The meetings are designed to inform dentists and members of allied dental groups on the issues involved in the current Thomas-Murray-Dingell legislation.

Speakers at the third district meeting in Albany included Philip J. Adams, of Boston, president-elect of the A.D.A.; William McGill Burns, of Brooklyn, and Daniel F. Lynch, of Washington, D. C., A.D.A. trustees; and David Wurzel, consultant to the committee. E. Harold Gale, president of the State Society, presided.

At the fourth and fifth district meetings, scheduled to be held at Saratoga and Syracuse on Sept. 20 and 21 respectively, Drs. Lynch and Adams were to be the principal speakers.

Lon W. Morrey editor of THE JOURNAL, Francis J. Garvey, secretary of the A.D.A. Council on Legislation and J. Ben Robinson, dean of the University of Maryland college of dentistry were scheduled to speak at meetings of the second and tenth district, in Brooklyn, Sept. 26, the first district, in New York City, Sept. 27 and the ninth district, in White Plains, Sept. 28. Similar meetings will be held in November in Buffalo, Rochester and Elmira. Dates for these meetings will be announced.

DENTAL EXAMINING BOARDS REPORT EXAMINATION DATES

A number of state dental examining boards reported dates for examinations in dentistry to THE JOURNAL during September. Those reporting follow:

California.—The next examinations for licensure in dentistry will be conducted by the State Board of Dental Examiners on Jan. 30, in San Francisco. They also will be given on June 19 in Los Angeles and again in San Francisco on July 24. Additional information may be secured by writing Kenneth I. Nesbitt, secretary of the Board, 507 Polk St., San Francisco 2.

Mississippi.—Examinations for licensure in both dentistry and dental hygiene will be conducted by the State Board of Den-

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tal Examiners Jan. 9-11, at Jackson. Additional information may be secured by writing John C. Boswell, secretary of the Board, 508 Lamar Building, Jackson.

Tennessee.—Examinations for licensure in dentistry will be conducted by the State Board of Dental Examiners in Memphis, Dec. 12-16, 1949. All applications should be in the hands of the secretary, James J. Vaughn, at least 30 days prior to the examination date. Application blanks and information may be secured by writing Dr. Vaughn, 1005-6 Medical Arts Building, Nashville 3.

Hawaii.—The Board of Dental Examiners for the Territory of Hawaii report that examinations for licensure in both dentistry and dental hygiene are held in February and August, in Honolulu. Requirements for examination in dentistry specify that the applicant must be a citizen, a graduate of an accredited school within the United States, and must have lived in Hawaii for one year prior to examination. The residency requisite is waived for dental hygienists.

ARMED FORCES

PROMOTIONS OF TWO DENTISTS OF HIGH RANK ARE CONFIRMED

The U. S. Senate has confirmed the promotion of Col. Louis H. Renfrow, long-time A.D.A. member and assistant to the Secretary of Defense, to the rank of brigadier general and elevated Brig. Gen. George R. Kennebeck, chief of the Air Force dental service, to the rank of major general.

Until recently Gen. Renfrow, also chairman of the A.D.A. Special Committee on War Memorial, was an assistant military aide to President Truman.

Gen. Kennebeck, a career dentist in the military service since 1917, was promoted to brigadier general in 1948.

V. A. REPORTS ON "HOME TOWN" DENTAL PROGRAM IN FISCAL 1949

During the fiscal year ended last June 30, a total of 430,271 veterans were treated under the Veterans Administration "home town" dental program by private dentists and 83,372 by dentists at V.A. installations. This information is contained in a report released Sept. 19 by the V.A. which emphasizes the point that 84 per cent of the treatment completed under the program was performed on the fee-for-service contract basis.

Dentists participating in the "home town" program are credited with having examined 263,150 veterans as compared with 315,689 examinations completed by V.A. staff dentists. In terms of cost to the government, Bion R. East, director of V.A.'s dental service, stated that $38,813,560 was paid to private practitioners and a valuation of $8,345,958 was placed on work done by his dental staff. A total of 56,937 private dentists were participating in the program on April 30.

Claims for the year totaled 763,365, which added to a backlog of 324,048 made a total workload for the year of 1,087,413 claims. Thirty-seven per cent of that workload, or 405,523 claims, were disallowed, cancelled or withdrawn while 518,472 were authorized treatment. A backlog of 163,418 cases remained on July 1 after completion during the year of 923,995 cases. This represents a reduction in the backlog of 50 per cent.

A tabulation of the number of private dentists who were participating in the program on April 30 will appear in the November issue of THE JOURNAL. Following is a tabulation of the treatment cases and examination cases completed in the year ended June 30 by both V.A. dentists and private practitioners:

TREATMENT CASES COMPLETED BY

	VA STAFF DENTISTS		PRIVATE FEE-BASIS DENTISTS	
	Number	Value	Number	Costs
Total	83,372	$4,898,173	430,271	$35,340,096
Alabama	1,334	63,328	5,016	348,651
Arizona	1,166	54,982	355	21,732
Arkansas	365	26,364	4,917	429,961
California	5,974	399,347	30,377	2,861,857
Colorado	1,712	81,009	2,136	126,951
Connecticut	74	5,061	9,028	796,205
Delaware	407	24,078	141	9,343
Florida	2,885	145,425	6,978	534,057
Georgia	1,082	60,686	8,130	591,573
Idaho	393	23,702	2,526	220,103
Illinois	4,615	323,766	20,167	1,921,294
Indiana	1,315	68,042	15,576	1,260,541
Iowa	517	32,850	7,693	650,342
Kansas	334	19,073	3,202	201,921
Kentucky	1,933	136,902	5,547	414,391
Louisiana	1,327	59,696	4,917	390,386
Maine	188	7,645	2,263	142,384
Maryland	1,926	98,514	1,666	145,554
Massachusetts	161	6,870	17,471	1,408,194
Michigan	2,527	153,878	10,816	771,362
Minnesota	1,235	62,384	18,523	1,170,718
Mississippi	424	18,680	2,406	200,190
Missouri	2,911	182,800	7,828	609,522
Montana	17	1,212	2,706	218,395
Nebraska	616	37,027	4,521	318,098
Nevada	128	3,404	574	54,259
New Hampshire	244	7,715	1,603	117,004
New Jersey	3,569	262,557	10,254	863,428
New Mexico	691	28,720	533	41,608
New York	6,681	400,341	71,677	6,223,134
North Carolina	1,434	90,834	8,383	688,840
North Dakota	52	3,068	5,847	336,138
Ohio	4,396	245,749	30,772	2,878,038
Oklahoma	998	47,760	4,669	320,553
Oregon	1,206	78,231	5,512	512,431
Pennsylvania	12,641	732,498	20,182	1,477,865
Rhode Island	664	39,794	1,463	121,060
South Carolina	335	16,323	3,404	293,801
South Dakota	481	24,175	1,923	111,039
Tennessee	441	32,608	4,464	359,919
Texas	5,013	242,479	7,995	586,236
Utah	1,331	45,598	1,278	77,244
Vermont	97	10,057	620	44,712
Virginia	628	42,291	6,228	539,499
Washington	511	18,174	11,536	1,178,331
West Virginia	1,206	61,792	2,381	189,693
Wisconsin	2,998	245,535	23,791	1,712,360
Wyoming	116	7,355	684	54,271
Alaska	0	0	422	52,576
District of Columbia	961	63,338	4,703	413,159
Hawaii	852	31,338	1,553	94,599
Puerto Rico	260	23,118	2,914	234,574

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EXAMINATION CASES COMPLETED

	Number	Value	Number	Costs
Total	315,689	$3,447,785	263,150	$ 3,473,464
Alabama	2,207	22,016	6,070	72,132
Arizona	1,331	12,615	148	1,136
Arkansas	1,837	25,945	4,763	72,156
California	24,415	276,854	13,653	186,359
Colorado	2,815	19,855	2,569	10,396
Connecticut	8,963	128,482	1,117	15,638
Delaware	495	3,781	156	1,060
Florida	9,071	110,979	3,737	52,565
Georgia	4,623	62,455	5,105	66,194
Idaho	559	6,334	2,558	32,022
Illinois	9,531	132,247	23,046	312,982
Indiana	3,645	48,909	13,545	179,041
Iowa	2,329	30,995	7,507	98,040
Kansas	1,568	17,643	2,637	35,826
Kentucky	4,266	48,415	3,317	42,723
Louisiana	1,881	34,419	4,340	82,744
Maine	1,882	25,960	961	12,821
Maryland	3,595	50,330	1,154	15,855
Massachusetts	13,505	189,070	7,111	99,554
Michigan	9,502	51,851	5,308	62,695
Minnesota	6,786	95,004	12,973	163,102
Mississippi	935	13,025	3,085	44,740
Missouri	7,493	93,102	5,901	82,590
Montana	395	4,645	2,764	36,445
Nebraska	1,310	13,377	3,966	44,716
Nevada	497	3,991	302	2,419
New Hampshire	1,411	18,082	1,055	14,318
New Jersey	13,027	125,141	2,015	36,988
New Mexico	1,262	8,934	517	4,999
New York	59,131	430,829	44,404	541,647
North Carolina	2,279	27,903	8,346	109,742
North Dakota	697	8,415	5,912	77,937
Ohio	25,010	292,719	9,913	136,429
Oklahoma	2,446	28,038	3,898	57,107
Oregon	4,547	54,835	2,355	31,657
Pennsylvania	34,003	332,005	3,554	35,507
Rhode Island	2,371	27,647	532	6,907
South Carolina	3,645	50,258	279	3,123
South Dakota	935	9,383	1,781	19,251
Tennessee	430	5,270	4,969	69,086
Texas	9,632	124,042	7,413	108,301
Utah	1,801	15,429	983	7,663
Vermont	808	9,186	67	738
Virginia	676	9,424	5,804	81,138
Washington	5,013	67,509	7,727	111,215
West Virginia	1,761	19,739	2,237	29,550
Wisconsin	9,311	130,354	7,959	111,288
Wyoming	214	1,951	723	8,193
Alaska	0	0	438	8,107
District of Columbia	5,008	67,942	1,409	19,063
Hawaii	1,691	8,598	310	3,176
Puerto Rico	3,144	51,853	757	14,383

DENTAL EDUCATION

CANADIAN DENTAL SCHOOL TO GIVE CONTINUATION COURSES

A series of short, intensive continuation courses in dentistry for the general practitioner will be conducted by the University of Toronto dental faculty during the 1949-50 school year under a grant from the W. K. Kellogg Foundation, Battle Creek, Mich.

Dean Roy G. Ellis, in announcing the courses, stated that they are designed to aid the general practitioner in keeping abreast of standard methods in practice and recent developments in dentistry. Instruction will be given through lectures, seminars and clinical demonstrations.

The courses and the dates on which they will be given are: dental public health conference, Nov. 10-12; endodontia, Dec. 5-9; operative dentistry, Feb. 13-17; roentgenology, Feb. 27-March 3; partial denture prosthesis, March 6-10; crown and bridge prosthesis, March 27-31; orthodontics, April 17-21; minor dental surgery, April 17-21, and pedodontia, April 24-28. For additional information write Dr. Ellis, University of Toronto faculty of dentistry, 230 College St.

DENTAL INTERNSHIPS OPEN AT NEW YORK CITY HOSPITAL

Applications are being received for dental internships at the Lincoln Hospital, a unit of the New York City Department of Hospitals, according to M. Hillel Feldman, director of the dental department. Service is for one year beginning on July 1, 1950. The internships carry full maintenance and training in diagnosis, exodontia and anesthesia. Additional information may be secured by writing Dr. Feldman, 730 Fifth Ave. at 57th St., New York 19.

PENNSYLVANIA ESTABLISHES ORAL ROENTGENOLOGY COURSE

The University of Pennsylvania graduate school of medicine has established a course in oral roentgenology through facilities of the Evans Institute, according to Dean William S. Parker, of Philadelphia. The course will be directed by Leroy M. Ennis, A.D.A. trustee and professor of roentgenology at the University's dental school.

To be given annually, the course will begin the first week in October and continue to the end of May and lead to a candidacy for the master of dental science degree. Tuition is $800. For additional information write Dr. Parker, 237 Medical Laboratories, University of Pennsylvania, Philadelphia 4.

NEW PROFESSORS APPOINTED BY TWO SCHOOLS OF DENTISTRY

The dental schools at both the University of Maryland and the University of Illinois have announced the appointment of new professors on their teaching staffs.

Kryle W. Preis, of Baltimore, who for many years taught orthodontics at the University of Maryland dental school, now is a full professor in the orthodontics department, according to Dean J. Ben Robinson. Dr. Preis fills the position left vacant by the resignation of George M. Anderson. He also is secretary of the Maryland State Board of Dental Examiners.

At the University of Illinois college of dentistry, Dean Allan G. Brodie has announced the appointment of Maury Massler as a professor. Formerly Dr. Massler was an associate professor in the department of pedodontia and has served on the school's dental faculty since 1939.

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It also was announced by Dean Brodie that Arthur Elfenbaum has been promoted from assistant professor in the admitting clinic to associate professor. Dr. Elfenbaum formerly taught at the St. John's School in Manchester, England.

PUBLIC HEALTH

NATIONAL DENTAL SOCIETY TABLES C-H-I RESOLUTION

Consideration of current attempts to establish a system of national compulsory health insurance in the United States was tabled by an "overwhelming vote of the delegates" of the National Dental Society, which held its annual meeting in Atlanta, Ga., Aug. 8-12. The Lincoln Dental Society, of Chicago, a constituent of the national negro dental organization is reported to have strongly opposed any expression of policy favorable to Thomas-Murray-Dingell legislation.

DENTAL SECTION OF APHA TO MEET IN NEW YORK, OCT. 24-28

The American Public Health Association will meet in New York, Oct. 24-28. Featured in the program of the dental section are half-day sessions on "research in the dental field in public health," and "a report on the topical fluoride program." Each subject will be discussed by five essayists.

A joint session with the medical care section of the Association to discuss compulsory health insurance in Britain will be held. Other joint sessions to be held include those with the American school health section and the maternal and child health section.

Speakers for the program include David B. Ast, chief, dental health section, Edward Schlesinger, director, bureau of maternal and child health and David E. Overton, all of the State of New York Department of Health; Norman S. Simmons, and John W. Hein, senior fellows in dental research, University of Rochester, Samuel Charles Miller, professor of periodontia, New York University dental school; William P. Kroschel, senior dental surgeon, U. S. Public Health Service; Roy D. Smiley, director of the dental health division, Indiana State Board of Health; John K. Ellis, health education representative, Illinois State Department of Public Health; L. S. Kleinschmidt, representative of the U. S. Public Health Service, and Margaret E. Erb, dental hygienist, Washington, D. C.

Principal speakers for the joint sessions will be Philip Blackerby, director, division of dentistry, W. K. Kellogg Foundation; Margaret H. Jeffreys, director of oral hygiene, Delaware State Board of Health; J. M. Wisan, director, Joseph Samuels Dental Clinic, Rhode Island Hospital, and Guttorm Toverud, professor of pedodontia, Dental School of Norway.

INTERNATIONAL

MEMBERSHIPS IN FEDERATION DENTAIRE INTERNATIONALE OPEN

For the first time since 1947, members of the American Dental Association are being offered memberships in the Federation Dentaire Internationale, the only world-wide confederation of national dental societies, Stanley D. Tylman, of Chicago, chairman of the A.D.A. Council on International Relations has announced.

Memberships available are for the current fiscal year 1949-1950 and Oren A. Oliver, former A.D.A. president and a vice-president of the F.D.I. has been appointed treasurer for enrollment of mem-

bers in the United States. Requests for new memberships or renewal of present memberships should be made through Dr. Oliver at 1915 Broadway, Nashville, Tenn. Annual dues are $5.

American dentists who enroll in the F.D.I. will be making a contribution to international dental solidarity, Dr. Oliver points out, adding that the F.D.I. is the international organization in dentistry comparable to those in medicine and other professions. In addition to the opportunity offered through membership to participate in the important work of the World Health Organization, of which the F.D.I. is a member, American members also will be eligible to subscribe to the new *International Dental Journal* which will publish its first issue in September 1950. Members also will be eligible to attend the annual meeting of the F.D.I. in Paris next July in addition to participation at a reduced fee in the Eleventh Dental Congress to be held in London in 1952.

The F.D.I. was founded in 1900 by Charles Godon, in Paris, and it conducted an International Dental Congress every five years. The Congresses were interrupted in 1941 by the war.

GENERAL NEWS

PATENTS OF INTEREST TO DENTISTS ARE REPORTED

U.S. patents applicable or pertaining to dentistry which have been issued recently are:

2,452,696, Robinson R. Stabler, means for dressing and repointing hypodermic needles; 2,452,697, Robison R. Stabler, device for shapening hypodermic needles; 2,452,866, Carl H. Oertel, colloid dental tray; 2,452,903, Earl G. Coffey, impression taking means; 2,453,303, Allen B. Cline, denture repair tool; 2,453,518, James B. King, holder for artificial teeth; 2,453,541, David Reiter, matrix retainer; 2,453,590, Noel J. Poux, hypodermic syringe; 2,453,591, Noel J. Poux, hypodermic syringe.

2,453,696, Phillips Brooks, dental root preparation instrument; 2,453,934, John L. Preston, surgical appliance for treating jaw and other facial bone fractures; 2,454,427, Dell E. Bell, device for removing extruded plaster from exterior surfaces of dental flasks; 2,454,456, Christie Joannides, material for dental purposes; 2,454,457, Christie Joannides, method of making dentures; 2,454,513, John P. Honey, shield for dental lathes; 2,454,602, Frederick F. Gunther, needle holder and sterilizer; 2,454,709, Eugene J. Molnar, alginate impression material containing chromic sulfate; 2,454,995, Elwood M. Curran, disposable tooth cleaning kit.

PREPAID HOSPITALIZATION GAINS IN POPULARITY REPORT SHOWS

On June 30 approximately 22 per cent of the population of the United States and 20 per cent of all Canadians were enrolled in the 90 Blue Cross Plans for prepayment of hospital expenses, a report by the Blue Cross Commission of the American Hospital Association shows. Total membership at the end of June was 34,554,012.

Paul R. Hawley, chief executive officer of the Commission, commenting on the increased membership, said that it "is a reflection of the wide acceptance of this voluntary way to prepay hospital care." Three states and the District of Columbia so far have registered enrollment of more than 40 per cent.

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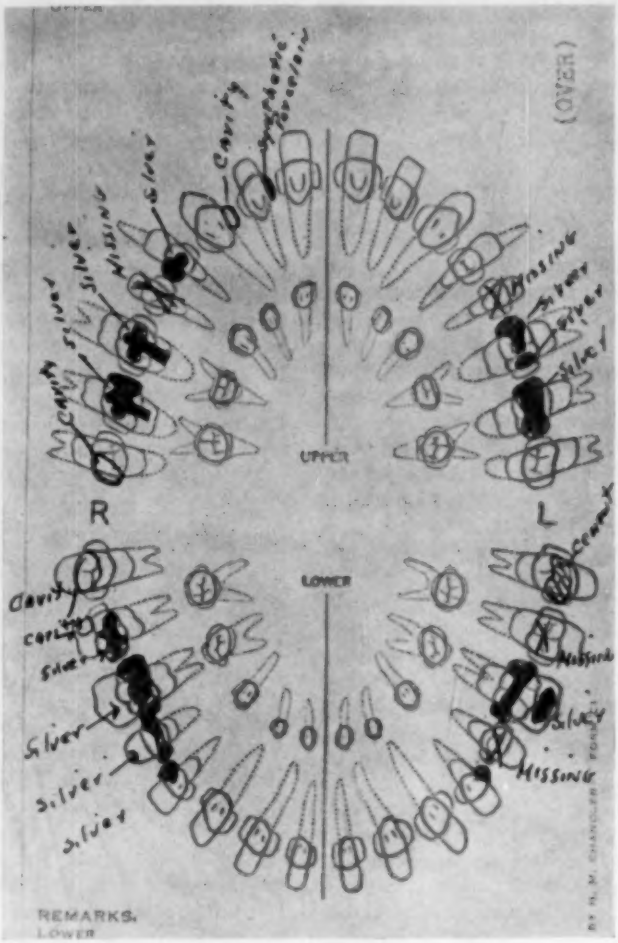

In an effort to establish the identity of a white man found floating in Long Island Sound off the coast at Darien, Conn., local police and the Federal Bureau of Investigation request that any dentist recognizing the dentition pictured above communicate with the police chief, Darien. A dental examination on Aug. 6 revealed that the lower left second molar recently was extracted and a cement filling recently was placed in the lower left third molar. The spongy appearance of the bone indicated the extraction was performed within the last six months. Bone construction of both the mandible and maxilla was dense, showing no evidence of recession of the bone due to infection.

BOOK REVIEWS

In the Dentist's Office. By G. Archanna Morrison. First edition. 253 pages with 31 illustrations and a colored chart. Index. Price $5. Philadelphia: J. B. Lippincott Company, 1948.

This book was written by G. Archanna Morrison because of her experiences as a dental assistant in Boston and her experiences as a lecturer and dental practice analyst. She felt that there was a great need of a book for reference in the dental office for an assistant, secretary or manager, and dental hygienist. The book is divided into three parts which include patient relations, the operating room, and clerical and general office duties.

Part one is written for all dental personnel as the author hopes that each one will apply and compare this material with her knowledge, experience, and personality and adapt it to the office where she is employed. The qualifications necessary in order to meet the public and the manner of even answering the telephone properly are stressed. Miss Morrison mentions the material available from the American Dental Association to educate the patient on correct reading matter in the reception room.

The second part of the book is also divided. The first section is for the untrained dental assistant. It will broaden her knowledge regarding dental anatomy, the correct nomenclature and phraseology, sterilization of instruments as well as the names, numbers, and the use of each instrument. The author also gives information regarding the materials and mixes such as silicates, amalgam and cements, which should be very helpful to any assistant.

The next portion of the book is devoted to the dental hygienist. A well written chapter on oral medicine is contributed by Lester W. Burket.

These chapters serve as a review for dental hygienists in the recognition and charting of the abnormalities of the hard and soft tissues. In recognizing diseases in early stages and informing her dentist of her findings, she can render invaluable service. The chart on the development of the human dentition may serve as a good reference as well as a patient education aid.

Part three of the book delves into the clerical and general office duties of a secretary or office manager. As the author states, the secretary or the hygienist, as the dentist's first representative, must be careful of her approach. The information on collections, presentation of general estimates, the manner in which one can establish a basic fee and on items deductible from income tax is worth reading. The phraseology of statements and letters, and usual telephone conversations in collecting delinquent accounts as written by the author should be an aid to the person in charge of that service.

This book should serve as a constant reference and a guide for dental office personnel. —*Evelyn Maas.*

Selected Works of Henry Clapp Sherman. By Henry Clapp Sherman. 1056 pages with 105 illustrations, 295 tables and 18 charts. Price $5. New York: The Macmillan Company, 1948.

This book was assembled as an expression of appreciation of Henry Clapp Sherman, Mitchill Professor Emeritus of Chemistry, Columbia University, who not only made notable contributions in all the major branches of the science of nutrition, but instilled the love of research in many who worked with him.

A total of 107 selected reprints of reports dealing with original research and twelve addresses and reviews compose the volume. These reveal the wide range of his interests in the discovery of facts and his versatility and enthusiastic sponsorship of the practical application of that knowledge. Dr. Sherman's basic ideal of service to his fellow men is well exemplified by his capacity and choice of work. More than 300 papers are listed chronologically, over 200 dealing with original research covering the span from 1895 to 1946. He also authored eleven books, some of which had a number of editions.

It is of value to assemble, in one volume, the tangible results of such an effective lifetime search for nutrition facts along with his own interpretation, correlation and practical adaptation. The field he opened offers a challenge to the oncoming generation of research workers.—*Dorothea F. Radusch.*

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Comes an Echo on the Breeze. By Edward J. Ryan. 202 pages. Price $3. New York: Exposition Press, 1949.

Dentists who have hobbies generally keep their basement, den or attic endeavors pretty much to themselves. Not so with Edward J. Ryan, of Evanston, Ill., a practicing dentist, dental editor, historian and novelist. His new novel, "Comes an Echo on the Breeze," is an example of what we mean.

Experts in Lincolniana might quarrel with Dr. Ryan's book on points of fact but it remains that this is primarily a romance about Northern Illinois and the last uprising of the Indian chief, Blackhawk. Young Abe Lincoln, now considered the Great Emancipator, lived in Northern Illinois and fought in the Blackhawk War under Andrew Jackson who also distinguished himself in the presidency of the United States. The author was indeed fortunate to have two such notable characters on whom he could hang the tale.

The adventures of Capt. Lincoln, related in the book through the author's grandmother—a pioneer lady whom he says did well to write her name—are very likely accurate enough to be interesting to most of those who occasionally wonder what Mr. Lincoln's boyhood "really was like." Dr. Ryan brushes away his "granny's" exaggerations in the fashion of a loyal grandson.

We can detect no particular significance of a dental nature in this book except perhaps that it might be prescribed for the dentist in search of a leisurely evening with one of the best story tellers in the profession.

Fundamental Considerations in Anesthesia. By Charles L. Burstein, M.D. 153 pages with illustrations. Index. Price $4. New York: The Macmillan Company, 1949.

This book is devoted entirely to the subject of anesthesia from the standpoint of anatomy, physiology and pharmacology. It has 15 chapters and an index which total 153 pages.

Emphasis is placed on a practical description of the complications that may develop from the physiology and pharmacology when administering general anesthesia. The book may be somewhat technical from the dental standpoint since it is directed primarily to the anesthesiologist.

The first chapter gives the function of the autonomic nervous system in relation to the anesthetic agent proper, the effect of a drug or drugs administered to the anesthetized subject and direct mechanical stimulation of the nervous tissue itself. Two chapters on respiratory disturbances involving apnea, and caroted body reflexes, hyperpnea, hypopnea, tachypnea, bradypnea, Cheyne-Stokes respiration, bronchoconstriction, and upper respiratory obstruction.

The author gives a definition of a laryngeal spasm as a valvelike closure of the laryngeal aperture. He reviews the anatomy of the larynx stating why and how a laryngeal closure may be accomplished. It usually occurs during light anesthesia and under no circumstances should any foreign material contact any part of the glottis, ventricular ligament or vocal cords.

Many helpful suggestions are offered in the chapters on shock, celiac plexus reflex, carotid sinus reflex, spinal anesthesia, and cardiac arrhythmias, all of which require special knowledge and care. Several references follow each chapter.

The book is carefully prepared and well written, and facts concerning anatomy, physiology and pharmacology pertaining to general anesthesia have been understandingly presented. It is highly recommended for all medical and dental personnel giving general anesthesia.—*Russell G. Boothe.*

Modern Drug Encyclopedia and Therapeutic Index. Edited by Marion E. Howard, M.D., F.A.C.P. Fourth Edition. 1283 pages. Therapeutic, Manufacturers' and Distributors', and General Indexes. Price $12. New York: Drug Publications, Inc.

Most of this book is devoted to a listing of commercial brands of drugs which are advertised principally to the professions. The informative material is supplied by the manufacturer or distributors and resembles that which appears on file cards which pharmaceutical firms send to physicians and dentists.

The therapeutic information is not sufficiently critical or comprehensive to justify use of the book as a therapeutic manual, and it will not be very useful to practicing dentists.

The *Modern Drug Encyclopedia* is useful to pharmacists, editors, drug manufacturers, librarians, and research workers as a ready source of information concerning the composition and claimed uses of trade preparations.

Molybdenum: Steels, Irons, Alloys. By R. S. Archer, J. Z. Briggs, and C. M. Loeb, Jr. 391 pages with 91 tables and 87 illustrations. Index. New York: Climax Molybdenum Co., 1948.

This book, apparently a commercial publication of high standard, is written by authorities of international reputation. The student of metallurgy will find this book extremely valuable. An extensive bibliography is appended to each section if the treatment of the subject given in the book is insufficient. Although the book is a noteworthy contribution to the literature of metallurgy, it is so technical that only the reader with a special background in metallurgy can appreciate it. Only part of one page is devoted to the subject of prosthetic alloys.—*Eugene W. Skinner.*

The Case Against Socialized Medicine. By Lawrence Sullivan. 53 pages. Price $1.50. Washington, D. C.: The Statesman Press, National Republic Publishing Company, 1948.

This little book, by a journalist who has written extensively on the problems and frustrations of the Federal bureaucracy, does not attempt to deal with all aspects of the present compulsory health insurance controversy. Instead, Mr. Sullivan selects what he considers are his opponent's most vulnerable points:

The proponents of the Murray-Wagner-Dingell (now Thomas-Murry-Dingell) legislation choose to ignore the fact that American medicine leads the world; government funds have been used to sell this legislation to the American public; draft statistics have been distorted to make it appear that the American public has many disabilities which could have been cured by prompt medical attention; and many of the basic ideas behind compulsory health insurance have communist origins.

This book was obviously not intended as a reference. In content and form it is more like a long pamphlet. Mr. Sullivan makes many of his points by inference, and, especially when he is tying this legislation in with Communism, he may be convincing only to the convinced. He obviously feels strongly about this issue, so strongly in fact that he risks losing those readers who want to decide for themselves.

Even so, he does make some interesting revelations. For example, he claims that the medical bureaucracy needed to administer a compulsory health insurance bill "would be greater in both manpower and total annual cost than was the entire federal establishment, including the Post Office, the Army and Navy, in the era 1920-1933." He also traces the origin of both European and American insurance plans to a model sickness insurance plan drawn up by the International Labor Office of the League of Nations in 1927.—*David Kinzer.*

Dentistry in Public Health. Edited by Walter J. Pelton and Jacob M. Wisan for the Dental Health Section of the American Public Health Association. 363 pages with 64 figures. Index. Price $5. Philadelphia: W. B. Saunders Company, 1949.

Seventeen authors have collaborated with the editors to produce this collection of monographs on dentistry in public health. It is designed to satisfy the widely recognized need for a textbook on public health dentistry for undergraduate dental students.

In describing the setting and problem, the opening section fails to develop a proper historical perspective of the public health campaign which was launched about a century ago in England. While the chronologic development of dentistry as a health service is established, its relation to the public health movement remains largely unexplained. The analysis of economic aspects of a dental health program is superficial.

The second section, embracing the tools available for attack on the dental problem, has considerable merit. A diversity of topics is explored, including dental health education, treatment in public health dentistry, evaluation of dental programs, and laboratory tests for caries activity. The fluorine-dental health relationship is critically examined and the pertinent literature is discriminatingly reviewed. The reader can scarcely escape the implications of the epidemiologic study of trace elements in relation to physiologic processes of large population groups.

The final section is addressed to the administrative problems of dental health programs with particular reference to rural, urban, state and federal activities.

The scant treatment of the professional manpower problem and the related subject of ancillary personnel seems lamentable in the light of its importance as a public health problem.—*S. S. Herman.*

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Contemporary Religious Jurisprudence. By I. H. Rubenstein. 120 pages. Price $2.50. Chicago: The Waldain Press.

The author has made a comprehensive study of the law relating to fortune telling, faith healing and some of the legal aspects of Christian Science. He has traced the history of various statutes on the subjects covered and has done exhaustive research into the case law affecting the topics discussed. While the book will prove of value to persons interested in statutes and case law relating to fortune telling and faith healing, it will probably have little general appeal to dentists as a class.—*Francis J. Garvey.*

Biochemistry of the Teeth. By Henry M. Leicester, Ph.D. 306 pages. Index. Price $5. St. Louis: C. V. Mosby Co., 1949.

This is a very worth-while book and one that has been needed for a long time. From the preface, we get the view from which the book was written. Leicester says: "Although the structure and mechanisms of formation of the teeth, the physiological factors which affect them, and the pathological processes which injure or destroy them have been much studied, these studies have not always been conducted to furnish direct information about the teeth. Often they have been carried out to throw light on other body mechanisms, on metabolism in general, or on some problem only remotely connected with the living organism. It is therefore not surprising that the literature on the subject is to be found widely scattered through journals in the fields of anatomy, biology, zoology, chemistry, physics and even geology, as well as in dentistry and medicine. It is the purpose of this book to attempt an integration of this literature."

This book achieves such an integration and more. In chapter after chapter, interesting hypotheses and much food for thought are presented. Unfortunately, however, several misstatements of fact occur. For instance, Leicester, influenced no doubt by the histologists with whom he is in contact, states that calcification takes place in the reverse direction from that of the growth of the enamel rods. The fact, however, seems to be that the calcification proceeds from the tip inward, without regard to the orientation of the enamel matrix. Taken as a whole, however, these disturbances can be overlooked since the book contains the most impressive and complete listing of pertinent literature on the teeth in all aspects including biochemistry that the reviewer has ever possessed.

The book is a great one not only because it is the first in this field but because it will be pre-eminent in the field for some time to come. —*Gustav Wm. Rapp.*

Perspectives in Medicine. The March of Medicine, 1948. Number XIII of the New York Academy of Medicine lectures to the laity. 163 pages. Index. Cloth. Price $2.50. New York: Columbia University Press, 1949.

Much thought-provoking material is contained in this little volume of six lectures to the laity. The thirteenth of a series promoted by the New York Academy of Medicine, it covers frontiers of medical research through discussions that are extremely pertinent, if not urgent, so far as man's future is concerned. One finds satisfaction in the reading, but at the same time experiences a certain perturbation over some of the trends that are pointed up so sharply. For example, in his discussion on "Food and Civilization" Sir Raphael Cilento, Director of the Social Division of the United Nations, points out a deadly parallel between the "New Deal" system of doles that hastened a dying Roman empire to its doom and our present alarming growth of doles, subsidies and coddlings that many feel are sapping the strength of our nation. The discussion of "The Atom in Civil Life" by Lewis L. Strauss, member of the U. S. Atomic Energy Commission and Naval Research Advisory Board, brings into sharp focus the many important aspects that concern us as individuals. Another equally helpful contribution is the lecture by William C. Menninger, M.D., of the Menninger Foundation in Topeka, Kan., on "Psychiatry for Everyday Needs." The roster is completed with a discussion of gerontology and geriatric medicine by Edward J. Stieglitz, M.D., the present and the future of cancer research by Cornelius P. Rhoads, M.D., and a scholarly analysis of the inter-relation of pure and applied science in medicine by James B. Conant, president of Harvard University.

Every thinking person will find this volume stimulating and helpful as a guide to what has been and what is to come.—*William W. Bolton.*

Review of Dentistry, Questions and Answers. By James T. Ginn, D.D.S. 810 pages. Price $5.75. St. Louis: C. V. Mosby Company, 1949.

It is always interesting to see how various authors differ in their presentation of information on the same general subject. Several books intended for those taking state board examinations have been published recently, "Review of Dentistry, Questions and Answers," being among them. In addition to the author, twenty-eight consultants assisted in the preparation of the book and, according to the preface, each chapter was carefully edited by one of these authorities.

Most of the questions and answers in the book are stated concisely but, perhaps, could have been made more understandable in some cases by the use of a few additional words. Also, where an answer differs from a generally accepted idea or is on a controversial subject, a brief explanation might be in order. In some instances cumbersome words not commonly found in the medical dictionaries are used, such as "Hyporiboflavinosis," on page 361, when riboflavin deficiency would be a more readily recognized term. The subjects needed for state board examinations are covered but one wonders if the chapters should not be arranged in a more logical sequence with related subjects following one another.

On the whole, this book is a fine help for those needing to review dentistry for any purpose and affords a great deal of concise information, fairly well indexed, at a reasonable price. It is a valuable addition to the question and answer books which are so popular at this time.—*Josephine P. Hunt.*

Repetitorium für das Zahnärztliche Staatsexamen (State Dental Examination Review). By Alfred Kantorowicz. 200 pages. Price $5.86. Index. Konstanz, Germany: Zahnärztliche Welt G.m.b.H., 1949—19.50 marks.

An over all review of dentistry, covering requirements for state dental examinations, has been prepared and edited in German by Dr. Kantorowicz, Professor of Dentistry, and Director of the Dental Institute of the University of Istanbul.

Material is presented in a question and answer form, in fifteen main divisions, including anatomy, histology, physiology, surgery, diseases of the teeth, prosthetics, orthodontics, roentgenology, diseases of the nasal cavity, peripheral nerve disorders, internal secretions, deficiency diseases, blood diseases, diseases of gynecological origin and social dentistry (*sic*).

Numerous subdivisions appear under each main classification. Under "Surgery," for example, is a section dealing with special oral surgery which covers chemical irritation of the mucous membrane, inflammation of the mucous membrane, ulcerative gingivitis, desquamative gingivitis, tartar, hypertrophic gingivitis, eruptions of mucous membrane, halitosis, suppurative disorders associated with erupting lower third molars, diseases of tongue and lip lesions, tetanus, tuberculosis manifested in the mouth, leukoplakia, tumors, cysts, cancer, benign and malignant growths, adamantinoma, odontoma, epulis, granulomas, clefts of lip and palate, fractures of upper and lower jaw, bone implants, osteomyelitis of jaw, necrotic processes, periodontal diseases, diseases of the temporomandibular joint, extraction, extraction of third molars, root resection and implantation of teeth.

Dental educators interested in standards of Europe should find it interesting to compare this German publication with the current book by V. R. Trapozzano titled *A Comprehensive Review of Dentistry for Use in Preparing for Dental State Board Licensing Examinations.* The two books are presented in a similar manner but Dr. Trapozanno's work is over three times as large as the foreign publication. It is interesting to note, also, that some phases of dentistry considered of utmost importance here are not listed at all in the German work.

A detailed table of contents, though perperhaps less ideal than an alphabetic index of material, should be adequate for locating desired references.—*Martha Ann Mann.*

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COUNCIL ON DENTAL TRADE AND LABORATORY RELATIONS

ACCREDITATION OF DENTAL LABORATORIES

Allison G. James, D.D.S., Beverly Hills, Calif.

THE BASIC PHILOSOPHY of governmental licensing of occupations is the protection of the public welfare. Unfortunately such acts also create certain monopolistic phases. If the concept of the act is faithful to the purpose of public protection then the monopolistic phase is relatively unimportant, but a necessary evil. Still more unfortunately it frequently appears that portions of our population lose sight of the basic purpose of special governmental regulation and see only the monopolistic advantage to be derived from such acts. This attitude has led to such a deluge of bills on state legislatures as occurred in California in 1949 when 23 new licensing boards were proposed. In the majority of these the most fervid and fevered imagination could hardly find a peg upon which to hang the "protection of the public" purpose.

The American Dental Association, in studying the dental laboratory technician problem, realized at an early date the fallacy inherent in considering licensure or other governmental registration of personnel not legally dealing directly with the public. It was and continues to be the opinion of those members of the American Dental Association charged with study of the matter entirely within the scope of the various state dental practice acts to control illegal practices of dentistry. While some state acts may require a stronger and sharper definition, nevertheless the responsibility for the dental health of the public lies directly in the hands of the licensed dentist. His is the responsibility for all acts of his auxiliaries as well as his own, and if he lives true to his professional tenets he assumes the responsibility without reservations. Recognition of this fact led the American Dental Association to support of the accreditation plan, the prime purpose of which is to improve the quality of dental services rendered the public, and only secondarily and incidentally to curb illegal practices. This plan comprehends education of the dentist as well as of the dental laboratory craft, and it is my sincere belief that with resultant improved dental service to the public, illegal practices of dentistry can gradually be eliminated through the workings of existent or improved dental practice acts.

Accreditation Requirements

The former Prosthetic Dental Service Committee of the American Dental Association brought forth an accreditation plan based on 14 requirements for accreditation of a dental laboratory. These points have been sufficiently publicized to

Member of the Council on Dental Trade and Laboratory Relations, American Dental Association, and Prosthetic Dental Service Committee, Southern California State Dental Association.

the profession to make unnecessary their reiteration here. The Prosthetic Dental Service Committee of the Southern California State Dental Association entered into discussions with representatives of the Southern California State Dental Laboratory Society early in 1944. It has been my privilege to serve on the Prosthetic Dental Service Committee of the state association continuously from that time. While certain suspicions appeared to exist on both sides and there were frequent clashes of personalities, nevertheless mutual acquaintance and familiarity with the problems under discussion gradually brought about understanding on both sides. Only by keeping the improvement of dental service to the public constantly in the foreground could the accord which has now been reached have occurred.

It was early recognized that one of the weaknesses of the general accreditation plan lay in its proposal to deal with individual laboratories rather than groups of laboratories. Also it was evident that problems at the state level varied so much from state to state that certain modifications would be necessary. During the later war years many problems arose and were met to the mutual satisfaction of both groups. But always there was a serious consideration of the accreditation plan and its possible application.

Early in 1946 a state level application of the American Dental Association plan was reached. To the original 14 requirements for accreditation were added two points and four general policies which are:

15. All members of the Laboratory Society shall be accredited if they meet the requirements as stated in the preceding articles within 90 days.

16. To be accredited a dental laboratory must be a member of the Dental Laboratory Society.

The four general policies are:

1. Policies and requirements must be reviewed at the end of each year and changes must be approved by the executive boards of each society.

2. Programs for the Southern California State Dental Laboratory Society on dental subjects, except those involving only laboratory procedures, should clear through the Prosthetic Dental Service Committee; and it is further agreed that all members of the Southern California State Dental Association appearing before the Southern California State Dental Laboratory Society as speakers shall be cleared through the Prosthetic Dental Service Committee of the Southern California State Dental Association.

3. All educational courses, clinics and demonstrations involving technicians as teachers or students shall first be approved by the joint Prosthetic Dental Service Committee of Southern California State Dental Association and the Liaison Committee of the Southern California State Dental Laboratory Society.

4. Members of the Southern California State Dental Laboratory Society shall be granted the privilege of admission to the commercial exhibits section of the annual meeting of the Southern California State Dental Association upon proper registration and without payment of fees.

A Cooperative Plan

This officially became a joint activity of the Southern California State Dental Association and the Southern California State Dental Laboratory Society on August 17, 1946.

The official adoption of the plan by both societies accomplished, it became necessary to establish a working mechanism for the operation of what, on paper, had appeared rather simple. There was no precedent and there was a fear, perhaps justifiable, that inspections could possibly develop into mere policing operations. Fortunately some of the wiser heads kept their vision constantly upon the ultimate goal, the improvement of

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dental service, and kept in mind that this was to be accomplished through a cooperative effort.

Laboratory Inspection

Inspection of approximately 100 laboratories was made possible by employment of a member of the association newly returned from the armed services and as yet unlocated for practice. Subsequently another member whose affairs permitted completed the inspection of another series of laboratories. This inspection of laboratories by one individual has since been succeeded by the plan of appointing three members of the local component societies to make joint inspections of two to three laboratories in their areas. A large segment of the dental association membership thus becomes acutely aware of both the accreditation plan and the state and number of laboratories serving the profession. Furthermore, it widens the laboratory-profession understanding. The inspection by a group of three members of the association has been a benefit to both sides.

To be effective such a cooperative plan must show benefits to both participants as well as achieve the goal always kept to the forefront—improvement of dental service. To this end clinics in pertinent procedures for the technicians of accredited laboratories were instituted semiannually. The first of such clinics, held in July 1947, presented 15 dentist clinicians to an audience of nearly 800 technicians and laboratory operators. Subsequent clinical programs have shown that the efficacy of this plan in improving interrelationships cannot be overestimated.

Publicity Campaign

Concurrently with all other activities a continuous publicity campaign for accreditation has been carried on in the editorial pages and otherwise in the *Journal of the Southern California State Dental Association,* as well as in the *Bulletin of the Southern California State Dental Laboratory Society.* The *Journal* carries lists of the accredited laboratories. There have been numerous editorials on the subject and several articles by members of the Prosthetic Dental Service Committee, urging members to patronize accredited laboratories and emphasizing the advantages thereof. Attention also has been directed to the impropriety as well as illegality of referring patients to dental laboratories for any services whatsoever. The legal necessity for written work authorizations or prescriptions has likewise been stressed.

Supplementary direct mailings to the membership have been employed, as, for example, one signed by the Prosthetic Dental Service Committee members:

> Will you please call your Dental Laboratory immediately and ask if it has been Accredited by the Southern California State Dental Association?
>
> IF NOT—WHY NOT?

At the January 1948 meeting of the Los Angeles Dental Society an open forum round table discussion was held with the Prosthetic Dental Service Committee of the Southern California State Dental Association, and the Liaison Committee of the Southern California State Dental Laboratory Society as participants. All members of the Laboratory Society were invited to attend this meeting and member dentists were encouraged to bring their personal dental laboratory technicians as guests. With an audience of approximately 1,000 the effectiveness of this program is evident. Arrangements have been made for a representative of the Prosthetic Dental Service Committee to explain accreditation to each component society at a regular meeting during the course of the year. An informed membership is vital for the success of the plan.

Revised Plan Adopted

Early in 1948 a program which was beginning to move rapidly and successfully appeared in danger of bogging down because of the unavoidable delays entailed in operation through the Central Office and the Prosthetic Dental Service Committee of the American Dental Association. Here in Southern California was a program which had far outstripped the pace established at a national level. If the state level gains were to be maintained the pace must even be accelerated and it therefore became evident to all concerned that the program must be carried forward at the state level alone, following of course the broad concepts previously established. Furthermore, the addition of points 15 and 16 in the accreditation requirements was not in conformity with the American Dental Association plan. With American Dental Association approval the state level was officially adopted, an appropriate insignia was designed and state association accreditation certificates were obtained. Under this plan the tempo has been considerably accelerated in 1949, with a result that two thirds of the laboratories in Southern California are now accredited. It is estimated that these two thirds of all the laboratories in this area produce approximately 95 per cent of the work done by commercial dental laboratories. With the benefits so evident to laboratory operators, it becomes a certainty that within a short period 100 per cent of the ethical laboratories will come into the fold, and it will be increasingly difficult for an unethical, unacceptable laboratory to survive.

The Prosthetic Dental Service Committee of the state association has proposed that the state dental laboratory society also appoint inspection committees to the end that all laboratories shall be periodically inspected, not only by the dental association, but also by their own laboratory society. This again should strengthen further the entire operation.

Additional clinics, lectures and lecture series are proposed for the future. An example of this activity was the lecture course of 15 hours in the characteristics of dental materials given under the University of California extension dental program. This course was available to technicians of accredited laboratories and was conducted in February 1949. There was an enthusiastic attendance.

Cooperative Plan Tested

Early in 1949 the efficacy of the cooperative plan was suddenly put to an unexpected test. Legislation unfavorable to the public dental health was introduced by interests inimical to dentistry. The dental laboratory craft rallied staunchly to the cause of ethical dentistry and twice sent their executive secretary to the state capitol to support the dental representatives in their opposition to this proposal, which was defeated.

A quotation from a recent official report on accreditation by the Southern California State Dental Laboratory Society is illuminating:

> The future of accreditation in California is secure, an enthusiasm toward it cannot help but grow as time goes on. Just how its mechanics will operate time alone can tell, but so long as there is the complete cooperation and trust, and so long as the actual elements are permitted to be kept fluid and alive to immediate problems, there will be no conflict.

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COUNCIL ON DENTAL RESEARCH

ADDITION TO LIST OF CERTIFIED DENTAL MATERIALS

SINCE the publication of the most recently revised lists of certified materials (List of Certified Dental Materials Revised to November 1, 1948, *J.A.D.A.* 38:358, March 1949, and Additions to List of Certified Dental Materials, *J.A.D.A.* 39:79, July 1949) the following product has been added:

Certified Zinc Phosphate Cement (A.D.A. Specification No. 8, First Revision)

Cement	*Manufacturer or Distributor*
Lang Dental Crown, Bridge and Inlay Cement	Lang Dental Manufacturing Company

BUREAU OF ECONOMIC RESEARCH AND STATISTICS

DISTRIBUTION OF DENTISTS IN THE UNITED STATES

RECENTLY THE DISTRIBUTION of all living dentists in the United States was determined. The count was made by tabulating the entries in the monthly supplements to the *American Dental Directory* and adding these changes to the count originally derived from the 1947 *Directory*. The supplements record deaths, changes of address, new dentists and corrections of previous entries in the supplements and in the *Directory*.

This count indicates that in mid-1949 there were 86,904 dentists in the 48 states and the District of Columbia, including 2,767 in the Army, Air Forces, Navy, Veterans Administration and U. S. Public Health Service. Exclusive of these federal government dental agencies, there were 84,137 dentists within the continental United States, which compares with 78,490 listed in the *American Dental Directory*, dated April 1, 1947. The increase amounts to 7.2 per cent, while the increase in civilian population during the two years ending July 1, 1949, according to the latest Bureau of the Census estimates, was 3.6 per cent.

From these figures it appears that the number of dentists is increasing faster, relatively, than the population. However, part of the increase in number of dentists —it is not possible to determine what part

Table 1.—Distribution of dentists in the United States

Region and state	Number of dentists*	Population per dentist	Estimated civilian population, July 1, 1948†
TOTAL	84,137	1,727	145,290,000
New England	6,335	1,441	9,126,000
Connecticut	1,486	1,336	1,985,000
Maine	425	2,106	895,000
Massachusetts	3,511	1,317	4,624,000
New Hampshire	261	1,992	520,000
Rhode Island	485	1,524	739,000
Vermont	167	2,174	363,000
Middle East	25,954	1,332	34,567,000
Delaware	134	2,239	300,000
District of Columbia	736	1,137	837,000
Maryland	848	2,505	2,124,000
New Jersey	3,177	1,489	4,730,000
New York	13,797	1,029	14,202,000
Pennsylvania	6,550	1,598	10,464,000
West Virginia	712	2,683	1,910,000
Southeast	9,062	3,283	29,751,000
Alabama	712	4,060	2,891,000
Arkansas	450	4,302	1,936,000
Florida	1,138	2,104	2,394,000
Georgia	882	3,563	3,143,000
Kentucky	934	3,029	2,829,000
Louisiana	1,025	2,518	2,581,000
Mississippi	486	4,329	2,104,000
North Carolina	967	3,885	3,757,000
South Carolina	436	4,472	1,950,000
Tennessee	1,002	3,164	3,170,000
Virginia	1,030	2,909	2,996,000
Southwest	3,496	3,099	10,833,000
Arizona	234	2,966	694,000
New Mexico	168	3,339	561,000
Oklahoma	838	2,727	2,285,000
Texas	2,256	3,233	7,293,000
Central	24,872	1,568	38,989,000
Illinois	6,300	1,317	8,300,000
Indiana	1,973	1,984	3,915,000
Iowa	1,705	1,532	2,612,000
Michigan	3,340	1,859	6,209,000
Minnesota	2,318	1,265	2,933,000
Missouri	2,571	1,513	3,890,000
Ohio	4,157	1,884	7,832,000
Wisconsin	2,508	1,315	3,298,000
Northwest	4,390	1,726	7,577,000
Colorado	775	1,529	1,185,000
Idaho	255	2,298	586,000
Kansas	1,011	1,861	1,881,000
Montana	305	1,669	509,000
Nebraska	932	1,372	1,279,000

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North Dakota	331	1,758	582,000
South Dakota	244	2,492	608,000
Utah	399	1,672	667,000
Wyoming	138	2,029	280,000
Far West	10,028	1,441	14,448,000
California	7,266	1,406	10,217,000
Nevada	93	1,763	164,000
Oregon	1,106	1,481	1,638,000
Washington	1,563	1,554	2,429,000

Federal Government Dental Corps	Number of Dentists
TOTAL	2,767
U. S. Army and U. S. Air Forces	793
U. S. Navy	941
U. S. Public Health Service	277
U. S. Veterans Administration	756

*Number of dentists is based on the *American Dental Directory*, 1947, and monthly supplements thereto through No. 8, August 1, 1949. Considering the time required for transfer of information regarding the status of dentists, it is estimated the figures in this table should be dated approximately June 1, 1949.

†Estimates of civilian population were taken from *Current Population Reports*, Series P-25, Bureau of the Census, August 5, 1949. State figures do not add exactly to the total given because these figures were rounded independently to the nearest thousand.

—resulted from the discovery of dentists not listed in the 1947 *Directory*. This *Directory* was a pioneering project and the next one will be more complete.

Although the distribution of dentists shown in Table 1 is dated 1949, the latest available population estimates by states are for 1948. The result is a bias in the ratios, making them generally too small. However, the per cent of error is slight and does not invalidate comparisons between ratios of different states. The Bureau of the Census estimates a net increase in civilian population during the year ending July 1, 1949, of 1.7 per cent.

For the year ending in mid-1949, state-to-state movements of dentists were tabulated separately from other changes in status. States with a considerably greater immigration than emigration of dentists, together with net increase thus incurred, were Florida, 43; California, 32; Connecticut, 23, and Washington, 20. States which had a sizable net loss in number of

Table 2.—Net change in number of dentists resulting from relocation. Approximate dates: June 1, 1948, to June 1, 1949

Region	Numerical change	Percentage change
New England	+11	+0.17
Middle East	−64	−0.25
Southeast	+15	+0.17
Southwest	+3	+0.09
Central	−132	−0.53
Northwest	−5	−0.11
Far West	+48	+0.49

dentists through relocation were Illinois, 67; Pennsylvania, 33; Missouri, 19, and Nebraska, 19. Table 2 shows, by region, net changes in number of dentists resulting from relocation during the one-year period.

The year 1950 promises more complete and accurate statistics on the distribution of dentists. A new *American Dental Directory* is scheduled for publication. From it a direct count of dentists can be made, eliminating the error that is bound to occur in the tabulation of changes from the supplements. Also in 1950 the decennial census will be taken, permitting population-dentist ratios to be based on actual counts rather than on estimates. The census will also produce a count of the practicing dentists, which, when compared with the total number of living dentists, should prove illuminating.—*B. Duane Moen.*

COUNCIL ON DENTAL THERAPEUTICS

COUNCIL ANNOUNCES ACCEPTANCE OF BRANDS OF PROCAINE PENICILLIN G WITH ALUMINUM MONOSTEARATE

PROCAINE Penicillin G, 300,000 units per cubic centimeter, in sesame or peanut oil, with 2 per cent of aluminum monostearate, is intended for repository use by deep intramuscular injection.

It can be relied on to maintain plasma penicillin levels above 0.03 unit for 96 hours following a single injection in about ninety per cent of patients. The levels are relatively constant during the 96 hour period and are appreciably lower during the first 24 hours than those achieved with penicillin or penicillin procaine preparations which do not contain aluminum monostearate.

When high initial plasma levels of penicillin are necessary, as in infections which are serious or resistant to low concentrations, forms of penicillin which are more rapidly absorbed should be used in place of or in addition to the product which contains aluminum monostearate.

The following brands have been accepted.

Crystalline Penicillin G Procaine in Oil, 300,000 Units per cc. (With Aluminum Monostearate): Each cubic centimeter of suspension is stated to contain crystalline penicillin G procaine, 300,000 units in sesame oil containing 2 per cent aluminum monostearate. In B-D[1] 1 cc. cartridges with B-D Disposable Cartridge Syringe and in 10 cc. vials.

Manufactured by Abbott Laboratories, North Chicago, Ill.

Crystalline Procaine Penicillin G in Oil, 300,000 Units per cc. (With Aluminum Monostearate): Each cubic centimeter of suspension is stated to contain penicillin G procaine, 300,000 units in peanut oil containing 2 per cent aluminum monostearate. In 1 cc. cartridges and in 10 cc. vials.

Manufactured by Bristol Laboratories, New York. U. S. Trademark: Flo-Cillin "96."

1. U. S. Trademark: Beckton, Dickinson & Company.

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COUNCIL ACCEPTS PRODUCTS FOR CLINICAL TRIAL

THE Council on Dental Therapeutics announces the acceptance of Ingram Ammonium Ion Tooth Powder and Craig-Martin Ammoniated Tooth Powder for clinical trial.[1]

Ingram Ammonium Ion Tooth Powder: Composition: Each 100 Gm. is stated to contain calcium carbonate, precipitated (Snow Top Heavy), 84.56 Gm.; bentonite, 5.08 Gm.; dibasic ammonium phosphate, 5.08 Gm.; urea, 3.05 Gm.; menthol, 0.20 Gm.; sulfocolaurate, 2.03 Gm., and flavor (peppermint oil, methyl salicylate), saccharin and tricalcium phosphate. Distributed by Bristol-Myers Company, New York. Licensed by the University of Illinois Foundation.

Craig-Martin Ammoniated Tooth Powder: Composition: Each 100 Gm. is stated to contain dibasic ammonium phosphate, 5.0 Gm.; urea, 3.0 Gm.; bentonite, 5.0 Gm.; calcium carbonate (Snow Top Heavy), 43.4 Gm.; calcium carbonate (Snow Top Light), 43.4 Gm.; saccharin, 0.2 Gm.; sulfocolaurate, 0.5 Gm., and flavor (menthol, methyl salicylate, anise oil, clove oil, sassafrass oil and cinnamic aldehyde).

Manufactured by Comfort Manufacturing Company, Chicago. Licensed by the University of Illinois Foundation.

1. Council Accepts Products for Clinical Trial. *J.A.D.A.* 37:705 (Dec.) 1948.

PRELIMINARY COMMENTS ON DENTAL PRODUCTS

THE following statements concerning products which are not accepted by the Council on Dental Therapeutics are designed to be free from controversial opinions. The Council may publish comprehensive status reports on these products whenever such reports are warranted, and will accept those which are found to be eligible for acceptance.

Amion Tooth Paste

Amion Tooth Paste is stated to contain, in each hundred grams, synthetic urea (carbamide), 8 Gm.; jack bean meal,[1] 1 Gm.; glycerin, 43 Gm.; dicalcium phosphate, 30 Gm.; tricalcium phosphate, about 10 Gm.; propylene glycol, 5 Gm.; saccharin; sulfocolaurate, and flavor.

Jack beans are described in the dictionary[2] under the heading "Canavalia" as "A small genus of tropical twining herbs of the pea family (Fabaceae). . . . They have long tough pods with large seeds

1. Soy bean meal, 4 Gm., is sometimes substituted for jack bean meal.

2. *Webster's New International Dictionary*, ed. 2, Springfield, Mass.: G. & C. Merriam Company, 1946, p. 389.

or beans, which are sometimes used for food when young, but more often to adulterate coffee." Jack bean meal contains urease, an enzyme which would tend to liberate ammonia from the urea under the influence of the moist conditions that prevail in the mouth. Sulfocolaurate is a foamy type of detergent.[3]

It is claimed in advertising that Amion Tooth Paste is useful in the prevention of dental caries, but evidence that it is effective for this purpose has not yet come to the attention of the Council. The distributing firm has initiated a scientific investigation of the product and has cooperated with the Council by supplying information.

'Eff-Remin' Dentifrice Special —With Sodium Fluoride

'Eff-Remin' Dentifrice Special—With Sodium Fluoride is 'Eff-Remin' Dentifrice (Andresen's formula) to which sodium fluoride 0.05 per cent has been added. The Council found 'Eff-Remin' Dentifrice not acceptable in 1939.[4]

According to the distributor, the sodium fluoride was added to 'Eff-Remin' because "current dental experience has shown that the incidence of dental caries has been reduced by the topical application of Sodium Fluoride to the teeth." The product is not advertised to the public.

Evidence to justify the inclusion of fluorides in dentifrices or mouth washes is lacking.[5,6]

Lyons Tooth Paste

Lyons Tooth Paste is stated to contain aluminum hydroxide, 46 per cent; glycerin, 28 per cent; water, 23.5 per cent; sodium lauryl sulfoacetate, 1 per cent; gum tragacanth, 0.65 per cent; methyl parahydroxybenzoate, 0.1 per cent; saccharin soluble, 0.05 per cent; flavor, q.s. The product is stated to be adjusted to a pH of 6.7 to 7.5. Aluminum hydroxide is an abrasive and polishing agent not usually employed in other dentifrices, methyl parahydroxybenzoate is a commonly used preservative, and sodium lauryl sulfoacetate is a widely used detergent.

According to the advertising, the dentifrice is "a revolutionary tooth paste . . . so utterly new, so radically different, so incredibly better than any other toothpaste for brightening teeth, it sets an all-time high standard for dental beauty. . . . Cleans *without soap!* Polishes *without Chalk!*" ". . . Gets teeth 2½ to 5½ times brighter than any other tooth paste!"

No therapeutic claims are made for Lyons Tooth Paste. The polishing claims are based upon publications.[7,8]

Sanoline Antiseptic Mouth Wash

Sanoline Antiseptic Mouth Wash is stated to contain "acid sodium benzoate," boric acid, eucalyptus oil, wintergreen oil, menthol, thymol, glycerin, and alcohol 25 per cent. The product is apparently designed to be used full strength.

The pH value of a sample purchased by the A.D.A. Bureau of Chemistry is 5.0. This probably explains the use of the otherwise meaningless term "acid sodium benzoate." Sodium benzoate would be largely converted to benzoic acid at a pH of 5.0.

According to the label it is "a scien-

3. *A.D.R.*, ed. 14, p. 122.

4. Council on Dental Therapeutics, American Dental Association, "Eff-Remin" Dentifrice Not Acceptable for A.D.R. *J.A.D.A.* 26:1887 (Nov.) 1939.

5. Bibby, B. G., A Test of the Effect of Fluoride-Containing Dentifrices on Dental Caries. *J. D. Res.* 24:297 (Dec.) 1945.

6. Council on Dental Therapeutics, American Dental Association, Council on Dental Therapeutics Reports on Topical Application of Fluorides. *J.A.D.A.* 34:700 (May 15) 1947.

7. Tainter, M. L.; Alford, C. E.; Hinkel, E. T., Jr.; Nachod, F. D., and Priznar, M., A Quantitative Method for Measuring Polish Produced by Dentifrices. *Proc. Sci. Section of the Toilet Goods Association* No. 7, 38 (May 16) 1947.

8. Alford, C. E.; Hinkel, E. T., Jr.; Nachod, F. C.; Priznar, M., and Tainter, M. L., Polishing Power of Dentifrices; Quantitative Studies. *J.A.D.A.* 36:270 (Mar.) 1948.

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tific preparation, astringent and deodorant for promoting hygienic conditions of the mouth, nose, throat, teeth, scalp, skin, mucous surfaces." Sanoline is claimed to be a deodorant if the mouth is rinsed with it after each meal. Controlled scientific evidence to support such claims is lacking.[9]

A routine inquiry sent to the firm in February, 1949, remains unanswered.

9. ADR, ed. 14, p. 131.

COUNCIL LISTS PRODUCTS FOR "ACCEPTED DENTAL REMEDIES"

THE Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following products in the list of *Accepted Dental Remedies:*

Anesthetics—Local[1]

Procaine HCl, 4%, Neo-Synephrine HCl 1:2500—Safco: Each cubic centimeter is stated to contain procaine HCl, 0.04 Gm.; phenylephrine HCl, 0.0004 Gm.; sodium bisulfite, 0.0019 Gm.; sodium chloride, 0.0037 Gm.; chlorobutanol, 0.005 Gm.; in distilled water. Marketed in 2.3 cc. cartridges.

Procaine HCl 4%, Epinephrine 1:65,000—Safco: Each cubic centimeter is stated to contain procaine HCl, 0.04 Gm.; epinephrine, 0.0000154 Gm.; sodium bisulfite, 0.0019 Gm.; sodium chloride, 0.0037 Gm.; chlorobutanol, 0.005 Gm.; in distilled water. Marketed in 2.3 cc. cartridges.

Manufactured by Safco Laboratories, Chicago.

Procaine HCl 4%, Neo-Synephrine HCl 1:3500—Lee: Composition: See Exodontia Products Co., A.D.R., ed. 14, p. 51.

Distributed by Lee Dental Supply, San Francisco.

Antibiotics and Antiseptics[2]

Powdalator Penicillin Sulfonamide Powder with Sulfanilamide: Each insufflator tube is stated to contain crystalline penicillin G postassium, 5000 units; sulfanilamide, 0.25 Gm.

Manufactured by Abbott Laboratories, North Chicago, Ill. U.S. patent No. 430,962 (July 1, 1947).

Phenetidine, Aminopyrine, Acetanild and Salicyl Compounds[3]

Bufferin: Each tablet is stated to contain acetylsalicylic acid, 0.3 Gm. (5 grains), with magnesium carbonate, aluminum glycinate, sugar, starch, gelatin and beeswax.

Manufactured by Bristol-Myers Company, New York City.

Mechanical Aids[4]

Veegum: Veegum is a complex colloidal magnesium aluminum silicate which is used as a bodying, dispersing

1. *A.D.R.*, ed. 14, p. 39.
2. *A.D.R.*, ed. 14, p. 59.
3. *A.D.R.*, ed. 14, p. 31.
4. *A.D.R.*, ed. 14, p. 125.

and stabilizing agent in tooth pastes and as a massing agent in tooth powders.

Manufactured by the R. C. Vanderbilt Co., Inc., New York City.

Admission to *Accepted Dental Remedies* means that the product was found to conform to the rules of the Council when it was accepted. Accepted products are reconsidered periodically. The files of the Council contain information on many drugs and dental cosmetics, and inquiries are welcomed.—*Donald A. Wallace, Secretary.*

COUNCIL REPORTS PROPHYLACTOL NOT ACCEPTABLE

PROPHYLACTOL, which is stated to be water soluble and to contain "no pumice, no acid," is a prophylactic paste distributed by Oral Products, Chicago.

No reply was received to a routine registered letter sent in 1948 from the Council Office requesting information on the product. A sample has been purchased on the open market.

According to a leaflet, the product operates on a "new principle," cleaning teeth in half chair time and destroying bad breath. It is stated to be "kind to gums."

The leaflet states that although dentists had been wondering why they were unable to procure a prophylactic paste that did not contain pumice or acid, the firm "wanted at least 4 years for research of all kinds as well as testimonials from most particular Dentists, who would use it in their own mouths and take it home for family use. All this has been done and now, we present New Principle PROPHYLACTOL Amazing Action . . . Prophylactol IS different . . . contains no pumice nor any injurious substance, yet, its action in removing stains is amazing . . . Any material that polishes like Prophylactol cannot scratch the most delicate surface, therefore it is impossible to cause injury to any kind of filling, teeth or gums. A perfect stimulation for gums with finger massage."

A preliminary examination of a sample of Prophylactol in the A.D.A. Bureau of Chemistry indicates that the product is a mixture of powdered silica, about 46 per cent, and water, together with small amounts of thickening and suspending agents and flavoring materials. When mixed with water, the pH was 8.5 at 27°C. Tests of the material by the glass scratch procedure indicate that the product is extremely abrasive as compared to many other commercial prophylactic pastes, pumice and similar abrasives.

The composition of the sample tested would indicate that Prophylactol is an effective scouring agent, but the Council does not have reason to believe that it is safe for use on the teeth, or that it would have any unusual effect upon breath odors.

Prophylactol is, therefore, not acceptable to the Council on Dental Therapeutics.

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COUNCIL REPORTS ON STATUS OF PEN-PHETAMINE

PEN-PHETAMINE consists of tablets each stated to contain racemic amphetamine ("Profetamine") phosphate, 3 mg.; acetylsalicylic acid, 5 grains (0.3 Gm.), and phenobarbital, ½ grain (20 mg.)

The label bears the following statements:

Indications: For symptomatic relief of dysmenorrhea and non-organic pain of any type. Caution: To be dispensed only by or on the prescription of a physician. May be contraindicated in cardiovascular disease, hypertension and extreme nervousness and insomnia. Warning—May be Habit Forming. "Pen-Phetamine" and "Profetamine" are registered trade marks. . . .

According to the advertising for Pen-Phetamine, the amphetamine phosphate decreases the perception of minor pains, and seems to minimize their intensity by an increased subjective feeling of well-being.

The actions of amphetamine, acetylsalicylic acid and phenobarbital, when considered individually, are well known. The use of mixtures of aspirin with the barbiturates has been common for many years.

The relative merit of various amphetamine salts and the actions of the mixture of drugs represented by Pen-Phetamine are not well established by evidence which has come to the attention of the Council. Pen-Phetamine is therefore not acceptable to the Council on Dental Therapeutics.

CASES AND COMMENTS

Disseminated Choroiditis and a Pulpless Tooth: Report of a Case.

By M. D. Gruber, D.D.S., State University of Iowa, College of Dentistry, Iowa City, Iowa.

A woman, aged 35, was seen in the Ophthalmology Department, State University of Iowa Hospitals, Iowa City, in June 1941. She complained of progressive loss of sight. A diagnosis of disseminated choroiditis was made. She was treated with tuberculin until July 1942. Her eyes were well until August 1948. She consulted her ophthalmologist and he gave the following report: "She had complained of progressive visual failure in the right eye for the past three weeks. Dust like particles were seen in the field of vision for that eye. PX vision right eye 6/9; and 6/6+ left eye with glasses. The external examination essentially negative with anterior chamber of normal depth in each eye and clear. Pupils were 2.5 mm. in diameter, round and free. Intraocular tension was not elevated to fingers. Viseral field studies with a tangent screen at 1200 mm. using the 1 mm. white target showed a scotoma in the upper visual field of the right eye and a sector defect in the upper visual field in the left eye. Fundi examination showed both lenses were clear. The vitreous in the right eye showed numerous fine dust-like floaters. The nerve head was indistinct especially below where there was an active edematous area of choroiditis. There were also several areas of healed chorioretinitis in the vicinity of the right macula. In the left eye the vitreous was clear except for one long string floater. There were also several areas of healed chorioretinitis in the vicinity of the macula. Diagnosis—Choroiditis juxta-papillaris in the right eye, old chorioretinitis each eye."

The patient's physical examination was essentially negative. She went to her local dentist for a dental examination and dental foci check. He found a pulpless lower right first molar. This tooth had been devitalized for many years. In 1947 a full cast crown was made to replace a defective M-O-D restoration in this tooth. At that time the x-ray was essentially negative. The patient was sent to the Oral Surgery Department, University of Iowa Hospitals, for consultation. It was a debatable question whether or not the tooth involved was a focus of infection, however, the patient was firm in requesting that the tooth be extracted. On August 26, 1948 the pulpless tooth was extracted. The ophthalmologist also obtained a 1+ reaction to 0.1 cc. of old tuberculin Dilution C. She was put on tuberculin therapy beginning with 0.1 cc. Dilution E old tuberculin subcutaneously. This treatment was carried on until February 5, 1949 when her last dose at that time was 0.5 cc. Dilution A old tuberculin.

The patient reported on October 15, 1948 that there was a great improvement in eye sight and that she first noticed this improvement on or about October 1, 1948. In February 1949 she reported that there had been no relapse in her eye sight. Her ophthalmologist reports that her eye condition is better. It is known by ophthalmologists that dental foci does play an active part in certain eye conditions. In this case we are unable to determine whether the extraction of the pulpless tooth or the tuberculin therapy, or both, can be credited with the improvement. The case does emphasize, however, that cooperation is necessary in the healing professions, and while certainly not a condemnation of root canal therapy, it does point to the need for complete study of the patient before certain treatments are proposed.

A Modified Crane-Kaplan Surgical Pocket Marker.

By Melvin L. Morris, D.D.S., M.A., New York.

The Crane-Kaplan surgical pocket marker[1] is an instrument for determining the amount of tissue to be removed in gingival resections. It resembles cotton pliers with one tip bent inward at right angles, sharpened to a knife edge. As the straight guiding tip is inserted into the pocket the blade is on the outer surface of the gingiva at the same level. Clos-

School of Dental and Oral Surgery of the Faculty of Medicine, Columbia University, New York; Department of Dental and Oral Surgery, Mt. Sinai Hospital, New York.

1. Crane, Arthur B., and Kaplan, Harry, The Technique and Results of Surgical Pyorrhea Treatment. *Dent. Digest* 38:3, 1932.

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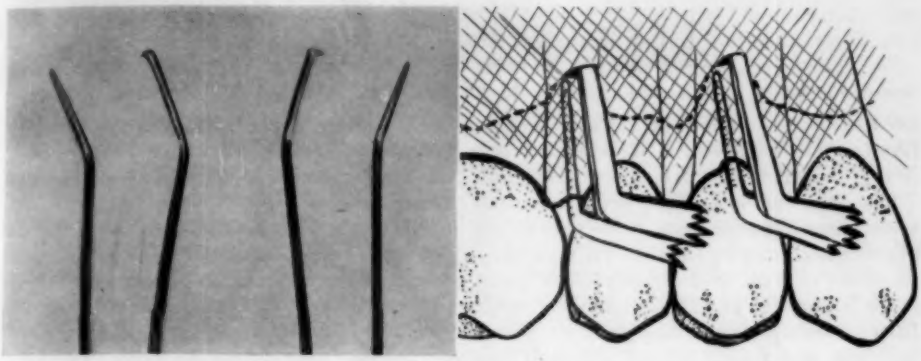

Left: Modified Crane-Kaplan surgical pocket markers. Right: Diagram showing uses for modified Crane-Kaplan surgical pocket markers

ing the instrument forces the blade into the tissue directly opposite the pocket depth. The resulting bleeding point acts as a guide for subsequent excision.

Simple and efficient, it is nevertheless limited in scope. Both ends are too short for deeper pockets and the flat guiding end cannot penetrate interproximal pockets.

Therefore, the instrument has been modified to reach the deepest pocket regardless of location. The guiding end has been rounded, and both ends have been lengthened. Since interproximal probing must be done at slightly less than vertical, the ends have been angled accordingly (Illustration, left). The use of the instrument is demonstrated in the illustration, right.

A Cautious Note on the Use of Penicillin in Dentistry.

By Robert S. Wolfsohn, D.D.S., Buffalo, N. Y.

Dentists today are subjected to much literature concerning the use of penicillin wherein we read how it "cures" Vincent's infection, has been a big help in periodontal disease and many other such cases of oral lesions. While observation of some results from the use of penicillin sprays on gum conditions among Army personnel, including Vincent's infection and gingivitis, indicated good response to penicillin therapy, a thorough scaling and curettage was necessary to prevent the reappearance of the lesions and symptoms within a few days. Also, if penicillin was not used, and deep curettage, scaling, hot salt water lavages, diet correction and toothbrush instruction were employed, the disease in most cases would be cured, because this type of gingival disease is mostly dependent on tissue tone.

Patients rarely break out in hives with a general malaise, or show some other such reaction after the first prescription of penicillin. Usually these conditions are not seen until later. The primary reason for abstaining from penicillin in gingival disorders is its self-sensitizing ability. Such sensitizaton may not appear until weeks, months or even years after the initial dose has been prescribed.

From case histories given to the physician by those who have been sensitized, we find that many of these people have used troches, lozenges, or the like orally. These were obtained at drug stores with and without prescriptions. Some physicians conclude that penicillin on mucous membrane has a strong propensity for sensitizing the individual. It is for this reason that we should not prescribe penicillin for those oral conditions which may be treated and cured by other satisfactory methods. At some future date, when a patient's life is imperiled due to a virulent bacterial strain, and penicillin is indicated, he will be unable to receive this treatment owing to a previous sensitization.—*175 Linwood Avenue.*

CURRENT LITERATURE

The Angulator—An Instrument for Measuring the Frankfort-Mandibular Angle. Maurice J. Savitz. Am. J. Orthodon. 34:1014 (December) 1948.

The angulator is a simple device for measuring, directly on the head of the patient, the Frankfort-mandibular angle. The measurements are read on the protractor which is part of the instrument. It will also give the distance from the tragion to the point where the Frankfort and mandibular planes intercept each other somewhere behind the head.

The main part of the angulator is made of a piece of sheet aluminum 16½ inches long, 2 inches wide and 1/16 inch thick. The sliding part is made up of a piece of aluminum 2½ inches by 1½ inches, of the same thickness as above. The ruler part is 12 to 15 inches long by ½ inch wide.

The patient is placed upright in the chair. The short arm of the angulator is put under the lower left border of the mandible with the right hand, while the left hand moves the ruler back and forth until the upper margin lies along the Frankfort plane. Now both readings are taken.

It is a very simple process and can be used for preliminary diagnosis at the patient's first visit.—*William F. Ford.*

General Practitioner's Desired Cooperation with the Orthodontist. Arthur E. Corby. Am. J. Orthodont. 35:279 (April) 1949.

Preventive dentistry is as much a responsibility of orthodontists as of general practitioners. In order to assume fully their share of this public responsibility, it seems incumbent on the men who practice orthodontics to work together with general practitioners and physicians as well as educate the public regarding their ability to correct various abnormalities.

Psychiatrists are aware of the influence of the emotions on the normal processes of the body, the tendency to such alterations leading to diseased conditions often of a chronic nature. These ailments in the past resisted all treatment but today, in the study of psychosomatics, we are collecting data of an important nature which we hope will help us some day to solve the mystery of many diseases now only vaguely understood. What part do the emotions play in the causation of cancer, arthritis, pernicious anemia, leukemia and other diseases?

Have the orthodontists considered the use of topical applications of fluorine just previous to the cementation of bands or the use of appliances which might impinge on the teeth?

In many cases of periodontoclasia the orthodontist can be of great service, with the age of the patient not too much of a handicap. Frequently a consultation between orthodontist and dentist might solve a dental problem without orthodontic appliances. The extraction of one tooth in an older person frequently is all that is required.

A very good suggestion for orthodontists is the practice of sending out cards or slips every six months to parents of their patients reading about as follows:

A Reminder to Orthodontic Patients

It is important to visit your dentist at least twice a year.

1. For removal of tartar forming under gums.
2. For minute examination of grooves and fissures.
3. For examination for cavities forming between the teeth which can often be detected only by an x-ray.

Patients under orthodontic treatment have the teeth which support the bands polished at each visit, but this does not take care of the dental examination and prophylaxis which are essential every six months.—*William F. Ford.*

Treatment of Irregularities of the Teeth and the Jaws by Means of Activators (Robin-Andresen Method). Charles Wachsman. Am. J. Orthodont. 35:61 (January) 1949.

At the beginning of this century Robin of Paris, and recently Andresen of Oslo, suggested a new principle incorporated in their device called an activator, the "monobloc." The latter utilizes as forces intermittent pressures. These are produced by the muscular function and are directed by the appliance in such a way that the teeth are moved toward the intended position.

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Advantages of Activators.—(1) The activator does not harm the tissue of periodontium. The stronger the patient bites into the appliance, the greater is the force applied. The latter is controlled owing to the sensitiveness of the teeth. The mobility of the teeth is very slight and quickly disappears. (2) With the use of the activator, the danger of increased caries susceptibility, a strong argument against Angle's method, is entirely absent. (3) In the treatment of the cases in Class II there is not the inconvenience of wearing intermaxillary elastics. (4) Using the activator we have the advantage that the same appliance which was used for treatment can be used as well for the retention. (5) It is difficult to retain the unremovable appliances in young patients. (6) As these appliances may be used in early childhood, their construction does not present any difficulties for the orthodontist. (7) Since they are removable they may be applied in those cases where occupations prevent the use of unremovable appliances. (8) The monobloc (activator) does not have to be controlled as often as an unremovable appliance. (9) Repairs are rare.

Disadvantages of Activators.—(1) The chief disadvantage is that the operator is dependent on the trustworthiness of the patient or his parents regarding the use of the appliance. (2) Since the patient wearing the activator is unable to breathe through the mouth, it is important that the nasal passage be open. (3) Monobloc activator is unable to improve several types or irregularities, for instance open-bite cases and protrusion of the mandible. (4) Patients are not able to speak while carrying the appliance.—*William F. Ford.*

The Dentist in the National Program of Cancer Control. Austin V. Deibert, Am. J. Pub. Health. 39:772 (June) 1949.

The dentist is in a critical position in cancer control because he often sees the patient with cancer occurring in the region of the head and neck before the physician. Histories of oral cancer patients at Memorial Hospital in New York show that 60 per cent with cancer of the gums had consulted their dentist first. In three out of five cases the dentist failed to recognize cancer.

The National Cancer Institute, aware that dentists trained to cancer alertness could save thousands of lives a year, has instituted a program for assistance in the teaching of dentists and dental students.

Since 1947 all but five of the approved dental schools have applied for a federal grant which provides up to $5,000 annually for cancer teaching. Aid is given to practicing dentists by supplying through public health officers materials for visual education.

By virtue of his key position the dentist has responsibility in prevention, recognition, rehabilitation and following up of cancer cases.

Prevention can be practiced by removing jagged edges of teeth and fillings; advising heavy users of tobacco and snuff of early changes in the mucous membrane; performing necessary periodontal therapy; correcting orthodontic anomalies; teaching correct oral hygiene.

Biopsy and microscopic examination by a specialist in histopathology are the means of recognition.

Rehabilitation of the cancer patient after treatment depends a great deal upon restoration of function and appearance by the dentist, plastic surgeon, and physician. The patient must also realize the necessity of continued follow-up examination and treatment.—*Charles F. Sumner, III.*

Rodents Used in Dental Research. V. J. Berzinskas and C. E. Mullins, Hosp. Corps Quart. 22:15 (February) 1949.

The authors of this article have presented, essentially, an evaluation of three different types of laboratory animals; the cotton rat, the white rat and the hamster. Each of these animals is considered on the basis of its value when used in diet-caries correlation studies such as are in progress now at the Naval Medical Research Institute (Experimental Dentistry Division). A brief outline is given of those methods of animal care which prevail at the Institute. The maintenance of an animal room, the numbering of animals and the general information which should be kept concerning each animal are all touched upon. Mention is also made of some necessary preparations which precede an experiment, such as the decisions upon size of litter, separation of animals into groups and means of eliminating sex and litter differences within such groups.

The writers summarize as well their preparation of sacrificed animal material for study. In connection with their mention of the grind-

ing and inspection of successive planes of jaw material, they present details of the charts employed to record both caries incidence and caries extent in the animal molar teeth.

The largest section of the paper is devoted to description and evaluation of the cotton rat, the white rat and the hamster. Over and above the presentation of standard facts such as adult weight, age of maturity, and gestation period, one can find here conclusions about the animals which are not everyday knowledge. It is made clear that the white rat ranks above the cotton rat in adaptability to laboratory conditions, tameness and rate of caries incidence upon a simple diet. One learns, moreover, that the Institute researchers consider the hamster pre-eminently suitable on a number of counts, not the least of these being its ability to develop smooth surface caries lesions after the manner of the human being.

Featured in this paper are diagrammatic sketches of unground and ground occlusal surfaces of the cotton rat molar and of caries lesions as they appear in the cotton rat and in the white rat. These sketches indicate one method of scoring gross caries involvement of the individual molar teeth. If such criteria of caries involvement are the sole ones used, they can be at best approximate. It is well known how extensive is the bacterial penetration of tooth substance prior to observable ground section lesions.

It should be stated that the paper possesses several inherent weaknesses. At no point are the main objective and purpose clearly stated. Satisfactory organization of the subject matter is lacking. Although the hamster is stated to be the rodent of choice, one finds the caries record and diagrams of carious lesions associated with rat teeth but none pertaining to the hamster. Unfortunate, too, is the absence of completeness in the listing of individual references. Nonetheless, selected portions of this article would be of positive value to neophyte research workers and to directors of future dental research projects involving laboratory animals.—*Alfred L. Ogilvie.*

Oral Color Photography as a Means of Personnel Identification and Registration of Oral Lesions and Deformities. B. L. Taylor and C. A. Schlack. U. S. Navy Project NM 012 004, X-767, Report No. 2. October 28, 1948.

The authors present with their report the accurate and unbiased abstract which follows:

"An apparatus for taking intraoral 35 mm. color photographs of anterior teeth and full upper and lower dental arches is described and illustrated. This apparatus, constructed to meet the requirements of mass intraoral photography, is easily operated by inexperienced personnel and can be used to photograph approximately 150 subjects daily. It utilizes metal mouth mirrors than can be removed readily for sterilization in steam or boiling water. Adjustable identification numbers are recorded on each side of all photographs to positively identify the subject. Lights, viewing mirror, and exposure mechanism are operated automatically by a single lever. Exposure time and focusing of the camera are predetermined and remain constant for all photographs."

The application of this method of intraoral photography should prove an invaluable adjunct to established systems for recording existing mouth conditions of large groups of subjects.—*John Sproule.*

Cancer Teaching in Dental Schools. Raymond F. Kaiser. Pub. Health Rep. 64:764 (June 17) 1949.

Realizing the potentialities of the dentist as a discoverer of early cancer, the National Advisory Cancer Council has recommended to the Surgeon General of the Public Health Service that grants of from $2,000 to $5,000 be made annually to dental schools for the purpose of improving the teaching of cancer. The Council made only three recommendations to schools applying for the grants: (1) that the dean and faculty review present teaching methods concerning cancer, (2) that the school consider a program of instruction in which biochemistry, pathology and physiology of cancer are correlated with a weekly clinic devoted to the presentation of cancer and that, whenever possible, advantage be taken of integrating the cancer teaching program of the dental school with that of the medical school, and (3) that they undertake to stimulate research in their school.

Already 36 schools have taken advantage of this teaching grant which the Council on Dental Education of the American Dental Association has approved.

Judging from budgets proposed by the schools, dental educators believe the deficiency in cancer teaching can best be corrected by (1) enlargement of teaching staff for cancer

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instruction and (2) addition and improvement of visual teaching aids.

More than half of the dental schools propose to establish a program of lectures on cancer as the backbone of their cancer training program with work and observation in tumor clinics within the dental school or in connection with a university medical school.

Most of the schools emphasize four subjects: the nature and cause of cancer, prevention, recognition of early cancer, and principles of diagnosis and therapy. Some schools have gone more deeply into certain aspects. In Michigan where state laws permit cancer treatment by oral surgeons, more emphasis may be placed upon therapy. In other schools actual technic of biopsy is taught, as well as the value and principles of this diagnostic method. At the University of Texas, the proposed program includes instruction in reconstruction and prosthesis following surgical treatment of cancer.

Year end progress reports received from the schools when they apply for renewal grants indicate a high degree of success in working out the proposed teaching projects.

Because these grants are obviously inadequate to make more than a good beginning toward a well-rounded cancer teaching program, it is hoped that these efforts will encourage other sources, possibly voluntary societies or educational foundations, to contribute additional funds for this needed program in dental schools.—*Charles F. Sumner, III.*

Journal of Oral Surgery
January 1949

Titles marked with an asterisk are reviewed below by H. L. Hubinger.

***The Necessity for Routine Roentgenographic Examination of the Edentulous Patient.** LeRoy M. Ennis and Harrison M. Berry, Jr., Philadelphia.—3.

***Surgical Preparation of the Mouth.** Frederick F. Molt, Seattle.—20.

***Pharmacology of the Newer Synthetic Analgesics.** M. H. Seevers, Ann Arbor.—30.

***Penicillin Therapy in Oral Surgery.** Philip M. Northrop, Ann Arbor.—39.

***Super-oxygenation in Nitrous Oxide and Oxygen Anesthesia.** John W. Seybold, Denver.—55.

***Cleft Lip and Palate.** A. L. Frew, Dallas.—59.

***Sialolithiasis.** Emil F. Tholen, Los Angeles.—63.

Gunshot Fracture of the Mandible. Douglas B. Parker, New York.—67.

Osteomyelitis of the Mandible. Douglas B. Parker, New York.—69.

Repair of Antro-oral Fistula. Richard J. Burch, Urbana, Ill.—72.

Excision of Areolar Hyperplasia with Electrocautery. Daniel J. Holland, Brookline, Mass.—75.

Chemotherapy of Osteomyelitis of the Mandible. Anthony J. Karpawich, Worcester, Mass.—76.

Obstructive Submaxillary Salivary Adenitis. James B. Smith, Danville, Pa.—78.

The Necessity for Routine Roentgenographic Examination of the Edentulous Patient. LeRoy M. Ennis and Harrison M. Berry, Jr.

The authors review the literature of routine roentgenographic examination of edentulous patients. They also report a large series of similar patients in which they found residual areas of infection, roots, and so forth.

They stress the use of the large intraoral roentgenogram supplemented by periapical films in the area of the maxillary third molar and mandibular incision. Their standardized technic of exposing the large intraoral film is described. This film allows better localization of residual areas of possible infection in the buccolingual aspect and to other anatomic landmarks.

They recommend the removal of residual roots and infection, except in a few cases where the trauma involved would contraindicate their removal.

Surgical Preparation of the Mouth. Frederick F. Molt.

The author states that the alveolectomy aids in the scientific replacement of teeth, the complete removal of debris and septic material, and the removal of abnormal or excessive osseous structure.

The author, while at the Great Lakes Naval Training Center during the war, allowed the retention of unerupted maxillary and mandibular third molars in edentulous recruits. This procedure was performed to preserve the tuberosity and posterior mandibular ridges. Comparison of cases, states the author, proved without question that this was a wise restriction placed upon the junior officer operators.

The degree of indicated process reduction differs with age and with osseous calcification as determined by the roentgenograms.

Pharmacology of the Newer Synthetic Analgesics. H. M. Seevers.

Metopon, a methyl derivative of Dilaudid, is one of the newer analgesics to supplant codeine and morphine. Side actions were absent in 90 per cent of the cases studied, and nausea the most common reaction in the other 10 per cent who experienced unpleasant symptoms. The drug is used for treatment of chronic pain and has very little sedative action; hence it would be inferior to morphine in preoperative medication. The recommended minimal dose is 6 mg. either orally or parenterally.

Merperidine, known as Demerol, is derived from the nitrogen containing ring of the morphine molecule. The ordinary dosage of 50 to 100 mg. administered parenterally is roughly equivalent to 5 to 10 mg. of morphine. The oral administration of merperidine is not especially satisfactory because the results are variable, due to inactivation in the intestinal tract. Sedation is minimal making it especially useful in the treatment of individuals in whom depression of respiration is feared. The drug also has a mild antispasmodic effect on smooth muscle. One of the most common side actions in ambulatory patients is vertigo.

Methadon, a synthetic compound, is comparable in potency to morphine in relieving pain. Analgesia is obtained with a minimum of sedative effect. In large doses (above 10 mg.) Methadon depresses respiration, somewhat comparable to the depression produced by morphine. The most satisfactory use for the drug in surgery is in treatment of severe postoperative pain where a dose of 10 mg., hypodermically, is usually effective in a high percentage of patients.

Penicillin Therapy in Oral Surgery. Philip M. Northrop.

The gram-positive organisms and certain gram-negative cocci are mainly sensitive to penicillin, whereas the majority of gram-negative bacilli are insensitive. It should be used where there is an infection by a penicillin sensitive microbe. This means it should not be used for colds, canker sores and so forth, unless for the purpose of preventing or controlling a secondary infection.

Individuals who have had allergic responses to penicillin in previous treatment can safely be re-penicillinized by the administration of antihistamine preparations.

Evidence accumulated during the past two years shows that penicillin therapy is curative in a high percentage of cases having subacute bacterial endocarditis. Prior to any surgery on these patients the prophylactic use of penicillin is advocated.

Super-oxygenation in Nitrous Oxide and Oxygen Anesthesia. John W. Seybold.

The anesthetic is started with oxygen 100 per cent at a 2 or 3 mm. flow with a gradual and progressive reduction of oxygen up to the point where eyelid resistance is lost. The author allows the patient to have four or five breaths of pure oxygen before starting the nitrous oxide. The intrapulmonary pressure is also gradually increased to approximately 10 mm. in the normal average patient. The author states that by this method there are no abrupt changes from consciousness to the first, second and third stages of anesthesia.

Cleft Lip and Palate. A. L. Frew.

The author closes the unilateral cleft lip and palate in three stages. The first operation is the closure of the anterior hard palate by a heavy-pressure method using wires through the bone. The second operation is closing of the lip at about 4 to 6 months of age. The third or final stage is the closure of the soft palate or all that remains open from the alveolar ridge back to the uvula.

Sialolothiasis. Emil F. Tholen.

Tholen reports his findings of 105 cases of salivary calculi.

In removal of the submaxillary calculi, the stone is made accessible by upward pressure on the gland. It should be prevented from shifting backward by the use of a wire suture.

The submaxillary gland should be removed if it is continually large and tender and contains the stone, also if it is the seat of degenerative changes or if the stones are multiple.

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DEATHS

Albright, Arthur N., Fresno, Calif.; Kansas City Dental College, 1911; died June 30; aged 61.

Allgeier, James H., Chicago; College of Dentistry, University of Illinois, 1918; died July 23; aged 50.

Anderson, Joseph N., Inglewood, Calif.; Colorado College of Dental Surgery, 1918; died July 18; aged 52.

Appleton, George N., Albany, N. Y.; New York College of Dentistry, 1894; died August 18; aged 80.

Armstrong, Ellsworth, Collingdale, Pa.; Medico-Chirurgical College of Philadelphia, 1901; died July 29; aged 77.

Beshur, Abraham, Chicago; died August 2; aged 69.

Blake, Ira, San Antonio, Texas; Atlanta Dental College, 1910; died May 14.

Bloch, Maxwell, York, Pa.; School of Dentistry, Temple University, 1920; died June 23; aged 42.

Blondel, Louis D., Caldwell, Idaho; College of Dentistry, University of Minnesota, 1906; died July 26; aged 66.

Bobb, John S. S., Millersburg, Pa.; School of Dentistry, Temple University, 1927; died July 31; aged 48.

Bowles, J. Green, Irvine, Ky.; Louisville College of Dentistry, 1905; died July 5; aged 67.

Burkett, Charles E., Seattle; Indiana Dental College, 1892; died July 23; aged 79.

Burritt, Elnore E., LaCrosse, Wis.; died July 12; aged 75.

Cassedy, Pierce A., South Orange, N. J.; School of Dentistry, University of Pennsylvania, 1915; died August 8; aged 56.

Castleman, Thomas B., Florence, Ky.; Cincinnati College of Dental Surgery, 1903; died in July; aged 81.

Chismore, Harry J., Grass Valley, Calif.; School of Dentistry, College of Physicians and Surgeons of San Francisco, 1900; died July 18; aged 69.

Clawson, Frank T., Plainfield, N. J.; New York College of Dentistry, 1890; died July 31; aged 80.

Colleran, William M., LaCrosse, Wis.; died July 25; aged 92.

Conway, Stephen V., Yakima, Wash.; College of Dentistry, University of Minnesota, 1908; died July 13; aged 69.

Coppage, H. Ross, Baltimore; Dental Dept., Baltimore Medical College, 1905; died August 11; aged 65.

Crosby, George L., Ronan, Mont.; College of Dentistry, Creighton University, 1926; died August 2; aged 45.

Davis, Hazelton B., Medford, Mass.; Dental School, Harvard University, 1918; died July 14; aged 54.

Dochterman, Layton, Chicago; Chicago College of Dental Surgery, 1935; died July 31; aged 48.

Donovan, Richard W., Wheeling, W. Va.; College of Dentistry, Ohio State University, 1939; died May 18; aged 39.

Doyle, Joseph M., Peru, Ind.; School of Dentistry, Indiana University, 1910; died August 4; aged 66.

Drazer, Lee L., St. Louis; Barnes Dental College, 1908; died June 21; aged 69.

Duncan, Herbert L., Winchester, Ky.; Louisville College of Dentistry, 1908; died July 24; aged 64.

Dunning, T. Star, Paterson, N. J.; New York College of Dentistry, 1896; died August 10; aged 78.

Edgar, Alexander G., Shillington, Pa.; School of Dentistry, Temple University, 1918; died August 11; aged 57.

Fallon, William E., Boston; Dental School, Harvard University, 1900; died July 20; aged 75.

Frazee, Owen L., Springfield, Ill.; Chicago College of Dental Surgery, 1896; died August 7; aged 82.

Fricke, Paul A., St. Joseph, Mo.; Western Dental College, 1915; died July 26; aged 61.

Fugler, Pearley M., McComb, Miss.; School of Dentistry, Vanderbilt University, 1903; died July 17; aged 70.

Gordon, Aloysius A., Chicago; Kansas City Western Dental College, 1925; died August 8; aged 53.

Gregory, Albert M., Columbia, Tenn.; School of Dentistry, Vanderbilt University, 1907; died July 7; aged 66.

Hall, Harry S., Seattle; North Pacific College of Oregon, School of Dentistry, 1916; died August 18; aged 60.

Hanna, Frank S., Denver; died July 8; aged 84.

Hansen, Harold J., LaCrosse, Wis.; Chicago College of Dental Surgery, 1900; died July 4; aged 79.

Hellman, Wilfurth, Oakland, Calif.; Western Dental College, 1912; died July 24; aged 59.

Hirsch, Francis C., New Dorp, S. I., N. Y.; School of Dental and Oral Surgery, Columbia University, 1926; died July 27; aged 45.

Hodgen, Joseph D., San Francisco; College of Dentistry, University of California, 1887; died July 8.

Holmes, Albert E., Middletown, Conn.; died July 20; aged 79.

Hood, John H., Cleveland; School of Dentistry, University of Pennsylvania, 1895; died August 2; aged 72.

Houck, Francis X., Altoona, Pa.; School of Dentistry, University of Pittsburgh, 1924; died July 27; aged 48.

Hudson, William A., Albany, N. Y.; Baltimore College of Dental Surgery, 1900; died in July; aged 75.

Hunt, E. Arden, Salt Lake City; School of Dentistry, St. Louis University, 1918; died July 22; aged 56.

Hurley, Daniel E., Troy, N. Y.; School of Dentistry, University of Buffalo, 1904; died July 19; aged 70.

Hyatt, John, Southport, N. C.; died July 24; aged 60.

James, William D., Tracy, Minn.; Baltimore College of Dental Surgery, 1889; died May 16; aged 82.

Johnson, Gustav A., Marquette, Mich.; Dental School, Northwestern University, 1929; died August 6; aged 44.

Johnson, William J., Philadelphia; Dental Dept., Baltimore Medical College, 1898; died August 4; aged 75.

Jureller, Paul D., Buffalo; School of Dentistry, University of Buffalo, 1919; died July 30; aged 53.

Kaho, Harry H., Claremore, Okla.; died July 13; aged 76.

Kaminski, Alphonse A., Milwaukee; Dental School, Marquette University, 1918; died July 30; aged 55.

Kean, J. L., Ronceverte, W. Va.; School of Dentistry and the Baltimore College of Dental Surgery, University of Maryland, 1887; died April 23; aged 90.

Kellam, Mervyn W., Baltimore; Baltimore College of Dental Surgery, 1944; died May 23; aged 27.

Koons, Fred W., Reading, Pa.; School of Dentistry, University of Pennsylvania, 1904; died July 27; aged 70.

Kuesel, George C., Philadelphia; School of Dentistry, University of Pennsylvania, 1890; died August 15; aged 79.

Levinger, Leo V., San Francisco; College of Dentistry, University of California, 1901; died July 12; aged 70.

Lewis, John E., Youngstown, Ohio; School of Dentistry, Ohio State University, 1915; died July 12; aged 72.

Mayers, Karl L., Galveston, Texas; Ohio College of Dental Surgery, University of Cincinnati, 1896; died July 16; aged 73.

Mayo, Edmund W., Holyoke, Mass.; Pennsylvania College of Dental Surgery, 1901; died July 23; aged 69.

McLaughlin, Frank E., Marion, Conn.; College of Dental Surgery, University of Michigan, 1895; died July 20; aged 79.

McParland, Patrick V., Pittsburgh; School of Dentistry, University of Pittsburgh, 1904; died August 3; aged 70.

Mills, Stephen B., Leedey, Okla.; Western Dental College, 1910; died June 11; aged 68.

Monks, James W., Memphis, Tenn.; College of Dental Surgery, University of Michigan, 1901; died July 21; aged 73.

Overbey, Andrew J., Philadelphia; Pennsylvania College of Dental Surgery, 1903; died July 23; aged 85.

Palmer, Fred N., Los Angeles; died July 17; aged 89.

Parks, Harle L., Atlanta, Ga.; Atlanta Southern Dental College, 1918; died in July; aged 57.

Paul, Charles E., Cresson, Pa.; School of Dentistry, University of Pittsburgh, 1923; August 2; aged 67.

Peay, W. Graves, Little Rock, Ark.; School of Dentistry, University of Louisville, 1922; died August 1; aged 52.

Perry, Alden E., Creston, Iowa; College of Dentistry, Creighton University, 1919; died July 7; aged 55.

Price, Little B., Pocohontas, Ark.; College of Dentistry, University of Tennessee, 1912; died June 24; aged 68.

Rhoads, C. P., Kansas City, Kan.; died June 6; aged 72.

Richardson, John H., Woodward, Okla.; Baltimore Medical College, Dental Dept., 1907; died July 15.

Robinson, Forest L., Chicago; Chicago College of Dental Surgery, 1914; died June 26.

Rugh, Fred W., Chicago; died in July; aged 60.

Schaake, Frederick W., Lawrence, Mass.; School of Dentistry, Georgetown University, 1906; died July 27; aged 64.

Senecal, Alphonse L., Plattsburg, N. Y.; School of Dentistry, Temple University, 1901; died August 9; aged 70.

Singer, Samuel, Paterson, N. J.; School of Dentistry, University of Pennsylvania, 1921; died July 31; aged 49.

Slack, William M., Memphis, Tenn.; New York College of Dentistry, 1886; died July 16; aged 87.

Smith, Shiloh S., Traverse City, Mich.; College of Dental Surgery, University of Michigan, 1902; died July 15; aged 74.

Spratley, William W., Richmond, Va.; Dental Department, University College of Medicine, 1910; died June 8; aged 63.

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Steiner, Max B., Seattle; College of Dental and Oral Surgery of New York, 1910; died July 30; aged 59.

Stephenson, Joshua E., Eagleville, Tenn.; College of Dentistry, University of Tennessee, 1911; died July 23; aged 60.

Stokes, James R., Rock Hill, S. C.; School of Dentistry, Vanderbilt University, 1903; died May 29; aged 72.

Stute, F. N., Elma Iowa; College of Dentistry, University of Iowa, 1899; died June 17; aged 75.

Sutphen, John D., Helena, Mont.; Pennsylvania College of Dental Surgery, 1900; died July 31; aged 70.

Swain, Charles E., New Britain, Conn.; Philadelphia Dental College, 1898; died May 18; aged 76.

Swofford, Monroe, Kansas City, Mo.; Western Dental College, 1897; died July 28; aged 83.

Taft, Eugene S., Freehold, N. J.; School of Dentistry, University of Pennsylvania, 1900; died August 2; aged 72.

Teeters, Walter J., Alliance, Ohio; Dental Department, Cincinnati College of Medicine and Surgery, 1899; died April 26.

Templeton, J. O., Winchester, Tenn.; School of Dentistry, Vanderbilt University, 1888; died May 18; aged 82.

Thomas, Albert R., Kalamazoo, Mich.; College of Dental Surgery, University of Michigan, 1900; died May 6; aged 82.

Van Deventer, Clarence H., Herington, Kan.; Kansas City Dental College, 1904; died July 13; aged 73.

Van Doorn, John W., Cleveland; College of Dentistry, New York University, 1890; died July 31; aged 86.

Wait, Wesley, Newburgh, N. Y.; New York College of Dentistry, 1884; died July 7; aged 88.

Wark, J. Arthur, Clifton Heights, N. J.; Philadelphia Dental School, 1896; died July 25; aged 79.

Waterman, Carl, Ballantine, Mont.; died July 2; aged 78.

Watt, John R., Chicago; Chicago College of Dental Surgery, 1896; died July 1; aged 93.

Weeks, Wilbur S., Melrose, Fla.; Pennsylvania College of Dental Surgery, 1907; died July 6.

Weintraub, Max, Washington, D. C.; School of Dentistry, Temple University, 1907; died May 19; aged 60.

Weiss, Othmar A., New Orleans; School of Dentistry, Tulane University, 1911; died July 28; aged 59.

Whalen, William F., Evanston, Ill.; Chicago College of Dental Surgery, 1892; died May 17.

White, Elbert S., Belvidere, Va.; died July 30; aged 76.

White, Ernest P., Barnesville, Ohio; died May 11; aged 77.

White, John E., New York; School of Dentistry, University of Buffalo, 1904; died June 4; aged 73.

Wilcox, Brainard A., Minonk, Ill.; Chicago College of Dental Surgery, 1908; died June 11; aged 64.

Wilcox, David S., Memphis, Tenn.; died May 26; aged 62.

Wilder, Robert E., Evanston, Ill.; College of Dentistry, University of Illinois, 1918; died August 18; aged 64.

Williams, Dan. L., Tipton, Mo.; Kansas City Dental College, 1905; died July 15; aged 67.

Wilson, Matthew, Rochester, Ind.; Chicago College of Dental Surgery, 1892; died June 17; aged 85.

Wisenbaugh, Ward C., Walkerton, Ind.; Indiana Dental College, 1913; died August 4; aged 61.

Wright, Alfred G., Philadelphia; died May 20; aged 85.

Wright, Harry M., Mount Sterling, Ky.; Louisville College of Dentistry, 1915; died July 6; aged 65.

Wurtsmith, F. L., Detroit; College of Dental Surgery, University of Michigan, 1929; died May 20; aged 45.

Yingling, Frederick M., Neodesha, Kan.; Kansas City Dental College, 1898; died July 16; aged 74.

Zaldin, Alfred, Flushing, N. Y.; Dental School, Tufts College, 1946; died June 4; aged 26.

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ANNOUNCEMENTS

MEETINGS OF STATE SOCIETIES

State	Date	Place	Secretary	Address
Alabama	May 1-3, 1950	Biloxi, Miss.	G. W. Matthews	1922 Tenth Ave., S., Birmingham 5
Arizona			H. G. DeWolf	Valley National Bank Bldg., Tucson
Arkansas			D. M. Hamm	White Bldg., Clarksville
California	April 24-26, 1950	San Francisco	L. R. Ludwigsen	450 Sutter St., San Francisco
S. California	April 3-5, 1950	Los Angeles	M. E. Ralston	Medico-Dental Bldg., Pomona
Colorado	Oct. 4-7, 1950	Colorado Springs	R. A. Downs	724 Republic Bldg., Denver 2
Connecticut			E. S. Arnold	37 Linnard Rd., W. Hartford
Delaware			Norbert L. Gladnick	1009 Madison St., Wilmington
D. of Columbia			K. H. Wood	202-1835 Eye St., N. W., Washington
Florida	Nov. 10-12	Palm Beach	L. M. Schulstad	Professional Bldg., Bradenton
Georgia	Nov. 13-15	Savannah	J. M. Heard, Jr.	Persons Bldg., Macon
Hawaii			J. H. Dawe	P. O. Box 39, Honolulu 10
Idaho	June 26-28, 1950	McCall	Allen R. Cutler	Eastman Bldg., Boise
Illinois			P. W. Clopper	623 Jefferson Bldg., Peoria 2
Indiana	May 15-17, 1950	Indianapolis	E. E. Ewbank	Kingman
Iowa	May 1-3, 1950	Des Moines	H. I. Wilson	639 Insurance Exchange, Des Moines
Kansas	May 7-10, 1950	Kansas City, Mo.	F. A. Richmond	1008 Huron Bldg., Kansas City
Kentucky	Mar. 29-31, 1950	Louisville	A. B. Coxwell	1976 Douglass Blvd., Louisville
Louisiana	April 14-16, 1950	Monroe	J. S. Bernhard	407 Medical Arts Bldg., Shreveport
Maine			P. W. Anderson	32 Deering St., Portland 3
Maryland	May 1-3, 1950	Baltimore	E. L. Pessagno, Jr.	415 Medical Arts Bldg., Baltimore 1
Massachusetts	May 1-4, 1950	Boston	A. M. Bommer	349 Broadway, Revere
Michigan	April 24-26, 1950	Detroit	F. Wertheimer	Michigan Dept of Health, Lansing
Minnesota	Feb. 20-22, 1950	St. Paul	C. V. E. Cassel	242 Lowry Medical Arts Bldg., St. Paul
Mississippi	June 11-14, 1950	Biloxi	F. C. Sneed	Osyka
Missouri	May 7-10, 1950	Kansas City	R. R. Rhoades	201 Merchants Bank Bldg., Jefferson City
Montana			C. S. Renouard	304 Phoenix Bldg., Butte
Nebraska	May 8-10, 1950	Omaha	F. A. Pierson	Federal Securities Bldg., Lincoln
Nevada	May 8-9, 1950	Las Vegas	Clifford A. Paice	Boggs Bldg., Las Vegas
New Hampshire			F. E. Williams	814 Elm St., Manchester
New Jersey	April 26-28, 1950	Atlantic City	J. G. Carr	407 Cooper St., Camden
New Mexico	May 22-24, 1950	Albuquerque	J. S. Eilar	First National Bank Bldg., Albuquerque
New York	June 5-8, 1950	New York	C. A. Wilkie	1 Hanson Place, Brooklyn
North Carolina	May 18-20, 1950	Pinehurst	R. F. Hunt	Rose Drug Co., Bldg., Rocky Mount
North Dakota	May 7-10, 1950	Fargo	A. L. Smeby	Northwood
Ohio	Nov. 13-16	Columbus	E. G. Jones	185 E. State St., Columbus
Oklahoma	April 16-19, 1950	Tulsa	F. H. Binkley	Hennessey
Oregon	Mar. 6-8, 1950	Portland	H. C. Fixott, Jr.	Medical Dental Bldg., Portland
Panama Canal Zone			R. O. Leon	Box 1094, Ancon
Pennsylvania			J. Wittek	217 State St., Harrisburg
Puerto Rico			F. Guerra	Avenida Ponce de Leon, Santurce
Rhode Island	Jan. 17-18, 1950	Providence	J. F. Colgan	838 Newport Ave., Pawtucket
South Carolina	May 7-9, 1950	Columbia	J. R. Owings	201 E. North St., Greenville
South Dakota	May 14-16, 1950	Huron	E. W. Elmen	Sioux Falls
Tennessee	May 8-10, 1950	Chattanooga	E. J. Justis	Exchange Bldg., Memphis
Texas	April 23-27, 1950	Dallas	W. Ogle	313 Medical Arts Bldg., Dallas
Utah			H. R. Nordberg	807 Tribune-Telegram Bldg., Salt Lake City
Vermont	May 22-24, 1950	Woodstock	J. A. Larrow	Middlebury
Virginia	April 17-19, 1950	Roanoke	J. E. John	804 Medical Arts Bldg., Roanoke
Washington			F. J. Dingler	1502 Medical-Dental Bldg., Seattle 1
West Virginia	May 15-17, 1950	Huntington	A. B. Drake	Huntington
Wisconsin	April 11-13, 1950	Milwaukee	R. A. Mason	964 N. 27th St., Milwaukee
Wyoming			T. A. Ward	Casper

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MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary	Address
California	Jan. 30, 1950 June 19, 1950 July 24, 1950	San Francisco Los Angeles San Francisco	K. I. Nesbitt	507 Polk St., San Francisco 2
Connecticut	Nov. 15-19*		C. G. Brooks	302 State St., New London
Indiana	Nov. 14-17*	Indianapolis	C. A. Frech	Gary National Bank Bldg., Gary
Michigan	Jan. 29-Feb. 4, 1950 June 11-June 17, 1950	Ann Arbor	J. L. Champagne	502 David Whitney Bldg., Detroit 26
New Jersey	Dec. 12-16† Dec. 12-13‡ June 5-9, 1950† June 5-6, 1950‡		W. A. Wilson	150 E. State St., Trenton 8
New York	Sept. 30-Oct. 1 Oct. 4-7	New York Buffalo	David W. Beier	23 S. Pearl St., Albany 7
Ohio	Oct. 24-28	Columbus	E. D. Lowry	79 E. State St., Columbus 15
Oregon	Nov. 7-10*		F. L. Utter	506 Pioneer Trust Bldg., Salem
Pennsylvania	Dec. 12-17† Dec. 12-14‡	Philadelphia	R. E. V. Miller	Northampton National Bank Bldg., Easton
Rhode Island	Dec. 6-7	Providence	F. M. Hackett	State Office Bldg., Divn. Professional Regulation, Providence

*Dentistry and dental hygiene.
†Dentistry.
‡Dental Hygiene.

OTHER MEETINGS

Name	Date	City	Secy. or Chm.	Address
Academy of Denture Prosthetics	May 1-7, 1950	Milwaukee	I. L. Furnas Secy.	La Jolla, Calif.
American Academy of Pedodontics	Oct. 14-15	San Francisco	E. C. Schildwachter Secy.	6831 Seville Ave., Huntington Park, Calif.
American Academy of Periodontology, Annual Meeting	Oct. 13-15	San Francisco	C. E. Chamberlain Secy.	115 North St., Peoria
American Association of Dental Examiners	Oct. 15-16	San Francisco	C. A. Bumstead Secy.	924 Stuart Bldg., Lincoln, Neb.
American Association of Public Health Dentists, Annual Meeting	Oct. 16	San Francisco	C. L. Sebelius Secy.	Tennessee Dept. of Public Health, Nashville 3, Tenn.
American College of Dentists	Oct. 16	San Francisco	O. W. Brandhorst Secy.	4952 Maryland Ave., St. Louis 8
American Dental Assistants Association, Silver Anniversary	Oct. 17-20*	San Francisco	Mary L. Martin	610 Jefferson Ave., La Porte, Ind.
American Dental Association, Ninetieth Annual Meeting	Oct. 17-20	San Francisco	H. Hillenbrand Secy.	222 E. Superior St., Chicago 11
American Dental Hygienists' Association, Twenty-Sixth Annual Meeting	Oct. 17-21	San Francisco	A. Rebekah Fisk Secy.	1830 Eye St., N. W., Washington, D. C.
American Dental Laboratories Association, Second Annual Meeting	Nov. 18-20	Cleveland	Ken Gall Chm. Program Committee	560 Rose Bldg., Cleveland 15
American Public Health Association, Seventy-Seventh Annual Meeting	Oct. 23	New York	R. M. Atwater Secy.	1790 Broadway, New York 19
American Society for the Advancement of General Anesthesia in Dentistry, Fall Meeting	Oct. 24	New York	M. H. Feldman Exec. Secy.	730 Fifth Ave., New York
American Society of Oral Surgeons, Thirty-First Annual Meeting	Oct. 12-15	San Francisco	Harry Bear Secy.	1112 E. Clay St., Richmond 19
Association of American Women Dentists	Oct. 17	San Francisco	Dora T. Smith Secy.	Cheda Bldg., San Anselmo, Calif.

*Examination for certification

Name	Date	City	Secy. or Chmn.	Address
Birmingham District Dental Society, Second Annual Early Autumn Clinic	Oct. 16-17	Birmingham	Ben Sapienza Chm.	Comer Bldg., Birmingham, Ala.
Detroit District Dental Society, Eighth Annual Dental Review	Nov. 2-3	Detroit	S. P. Jesson Chm.	4421 Woodward Ave., Detroit 1
Greater New York Dental Meeting, Twenty-Fifth Anniversary	Dec. 5-9	New York	H. S. Horton Chm. Press & Publication	Rm. 106A, Hotel Statler, New York 1
Midcontinent Dental Congress, Ninth Annual Meeting	Nov. 27-30	St. Louis	J. E. Brophy Secy.	Syndicate Trust Bldg., St. Louis
National Association of Seventh-Day Adventist Dentists, Annual Meeting	Oct. 14-15	San Francisco	A. C. Koppel Secy.	437 Cedar St., N. W. Washington, D. C.
National Board of Dental Examiners	Dec. 5-6†		G. L. Teall Secy.	Box 71, Hiawatha, Kan.
New England Dental Society, Annual Meeting	Oct. 5-6	Boston	A. R. Wilson Secy.	43 Farmington Ave., Hartford
New Orleans Dental Conference, Second Annual Scientific Meeting	Nov. 13-16	New Orleans	New Orleans Dental Conference	8117 Oak St., New Orleans 18
Northeastern Society of Orthodontists	Nov. 28-29	New York	Oscar Jacobson Secy.	35 W. 81st St., New York
Rocky Mountain Midwinter Dental Meeting	Jan. 8-11, 1950	Denver	G. H. Siersma Secy.	724 Republic Bldg., Denver 2
Southern Society of Orthodontists	Oct. 30-Nov. 1	New Orleans	F. P. Bowyer	608 Medical Arts Bldg., Knoxville, Tenn.
University of Buffalo Dental Alumni Association, Forty-Seventh Annual Meeting	Nov. 8-10	Buffalo	R. L. Montgomery Chm. Press & Publications	675 Delaware Ave., Buffalo

†Examinations (Part I and Part II) will be held in schools where there are five or more candidates